FLOWSTAR 2005™

USER'S MANUAL

HP-242
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HOFFER FLOW CONTROLS, INC.
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FLOWSTAR™ 2005
User's Manual

DocNo HP242

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1 INTRODUCTION

1.1 INTRODUCTION

The Flowstar series is a cost effective family of flow products designed to accept inputs from pulse producing flowmeters. This manual details instructions on the installation and use of the;

- Model 2005 - Volumetric flowrate indicator/totalizer for liquids.

Performance enhancement features such as flowmeter linearization, are available. Such performance enhancement techniques greatly improve the accuracy of the flow measurement system by correcting for known sources of measurement error.

The front membrane panel features a two line 16 character alpha numeric display that indicates function and unit of measure in English or Metric units. The display is a backlit LED type with .32" (8.13 mm) character height. The keypad is a bubble switch membrane type and sealed to NEMA 4X rating.

The unit is factory programmed when purchased with a Hoffer turbine flowmeter. This feature should save the user numerous hours of set up time that is associated with other microprocessor based units available in the marketplace. Programming is done through the front panel keyboard, as well as via a two way RS-232 or RS-422/RS-485(half duplex) multi-drop communication port.

Two analog input channels are available. These two channels are used for temperature and pressure inputs. Two analog output signals are available for transmission of process variables to remote data acquisition systems or chart recorders.

A scaled pulse output is provided for such applications as driving a remote flow totalizer or computer pulse input card. High and low alarms are available in either an open collector pulse form or OPTO-22 rely form.

1.2 PERFORMANCE CHARACTERISTICS

1.2.1 DISPLAY

- Two line, 16 char Alpha numeric, LCD, LED backlit
- Character height 0.32", super-twist +/- 20 degree viewing angle.
- Options: Front display heater, less LED backlight for battery supplied operations

1.2.2 ANNUNCIATORS

- 6 LED indicators for high/low flow, temperature, pressure.
- 1 piezo electric sonic alarm.

1.2.3 OUTPUTS(4):

Output features are designed to meet as wide a variety of user applications as possible. Each output will be software selectable from a list of available outputs. **All units will come standard with active low NPN open collector outputs**. For applications requiring additional output capabilities, a selection of on board modular relays will be provided for each output.

OPTIONAL OPTO-22 MODULE SELECTION

AC MODULE FEATURES

- Built in LED status indicator.
- Removable fuse.
- 4000 VAC optical isolation.
- Withstands one second surge @ 5 amps.
- Current rating of 3 Amps at 45°C.
- Line voltage 24 to 280 Vac.
- Operating temperature: -30 to 70°C.

DRY CONTACT MODULE FEATURES

- 100 VDC/130 VAC switching volts.
- 0.5 amps switching current.
- 1.5 amps carry current.
- 5,000,000 cycle life.
- 1500 VDC isolation voltage.
- Operating temperature: 0 to 70°C.

1.2.4 SOFTWARE SELECTABLE OUTPUT CHOICES (select any 4)

FLOW RELATED

- SCALED PULSE OUT.

ALARM RELATED

- ALARM (High and Low setpoints for process control).

1.2.5 KEYPAD

- 12 key numeric, 8 key mode control keypad, bubble switch membrane.

1.2.6 INPUT

- Single channel, pulse input, 10 mVrms to 5 Vrms, 10 to 1000 Hz, 50 K-ohm input impedance, maximum input frequency is 3500 Hz.
- Quadrature detection, pulse input, 10 mVrms to 5 Vrms, 10 to 1000 Hz, 50 K-ohm input impedance, maximum input frequency is 3500 Hz.
- Optional: MCP pickup.

1.2.7 PROCESS INPUTS(3)

- 1-5Vdc(STD).
- 4-20mA current loop, (Optional).

1.2.8 ANALOG OUTPUTS(2)

- Standard 0-5Vdc.
- 0-10Vdc.
- 4-20mA current loop, meets and exceeds ISA-S50.1 specifications for TYPE 3, Class L and U.

1.2.9 SERIAL COMMUNICATION

- RS-422\RS-485(Half Duplex) multi-drop.
- RS-232C, plug in sockets standard.

1.2.10 DIP SWITCH PROGRAMMABLE FEATURES (7)

- Program Enable.
- Local Control.
- Input Channel 2(Temperature).
- Input Channel 3(Pressure).
- Output Channel 1.
- Output Channel 2.
- Units English, Metric

1.2.11 SELF DIAGNOSTIC

- Unit checks computer hardware for proper operation (RAM, ROM checksum, RTC test only).
- Unit checks for transmitter signal loss and over-range conditions.
- Unit checks phase conditions of fluid being measured and displays error messages for TWO PHASE FLOW, GAS INHIBIT, and OUT OF COMP RANGE.

1.2.12 INPUT POWER

- 110/220 VAC 50-60hz selectable on board or 12-24 VDC with external supplied source.

1.2.13 ENVIRONMENTAL

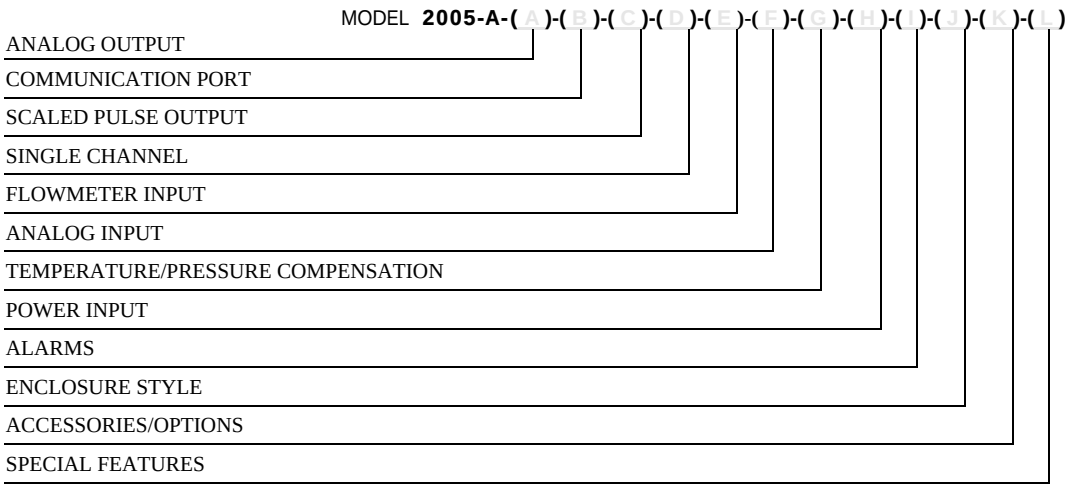
- 0 to 70°C Operating Temperature, -20 to 80°C Storage Temperature.

1.2.14 ENCLOSURE

- DIN Standard 43700, flame retardant, glass filled Noryl case, Dimensions: 7.4 x 3.6 x 7.25.

1.3 ORDERING INFORMATION

MODEL 2005-A FLOWSTAR
LIQUID MASS SINGLE CHANNEL



ANALOG OUTPUT (TWO MAY BE SELECTED)
MODEL **2005-A-(A)-( )-( )-( )-( )-( )-( )-( )-( )-( )-( )**

OPTION (A)	
(3)	0-5 VDC
(D3)	DUAL 0-5 VDC
(4)	0-10 VDC
(D4)	DUAL 0-10 VDC
(7)	4-20 MA
(D7)	DUAL 4-20 MA
(D3/4)	ONE 0-5 VDC AND ONE 0-10 VDC
(D3/7)	ONE 0-5 VDC AND ONE 4-20 MA
(D4/7)	ONE 0-10 VDC AND ONE 4-20 MA

COMMUNICATION PORT (SELECT ONE)
MODEL **2005-A-( )-(B)-( )-( )-( )-( )-( )-( )-( )-( )-( )**

OPTION (B)	
(R2)	RS-232
(R4)	RS-485 HALF DUPLEX

SCALED PULSE OUTPUT (TWO MAY BE SELECTED INCLUDING ALARM OPTIONS)
MODEL **2005-A-( )-( )-(C)-( )-( )-( )-( )-( )-( )-( )-( )**

OPTION (C)	
(1)	OPEN COLLECTOR (STANDARD)
(2)	TTL/CMOS
(3)	DRY CONTACT

SINGLE CHANNEL ONLY (SEE NOVA-FLOW FOR MULTIPLE CHANNELS)
MODEL **2005-A-( )-( )-( )-(D)-( )-( )-( )-( )-( )-( )-( )**

OPTION (D)	
(1)	SINGLE CHANNEL

FLOWMETER INPUT
MODEL **2005-A-( )-( )-( )-( )-(E)-( )-( )-( )-( )-( )-( )**

OPTION (E)	
(M)	MAGNETIC COIL
(MC3PA)	RF COIL
(RPM)	MAGNETIC REDI-PULSE COIL
(RPR)	RF REDI-PULSE COIL
(DMX)	MAGNETIC REDI-PULSE I.S. COIL
(DRX)	RF REDI-PULSE I.S. COIL
(DC)	DRY CONTACT

MODEL 2005-A (CONTINUED)

ANALOG INPUT & TEMPERATURE/PRESSURE COMPENSATION
MODEL **2005-A-( )-( )-( )-( )-( )-(F)-( )-( )-( )-( )-( )**

OPTION (F)

(7)	4-20 MA
(2/7)	DUAL 4-20 MA - REQUIRED IF BOTH T & P REQUIRED

TEMPERATURE COMPENSATION/PRESSURE COMPENSATION/ONE FLUID
MODEL **2005-A-( )-( )-( )-( )-( )-( )-(G)-( )-( )-( )-( )**

OPTION (G)

(T)	TEMPERATURE - REQUIRES RTD WITH TRANSMITTER
(TP)	TEMPERATURE & PRESSURE - REQUIRES RTD **(MANY FLUIDS DO NOT REQUIRE PRESSURE COMPENSATION. CHECK WITH ENGINEERING FOR YOUR FLUID.)**
(UVC)	VISCOSITY COMPENSATION (TABLE) **MUST BE USED WITH OPTION (T) OR (TP).** **SPECIFY FLUID, TEMPERATURE AND PRESSURE WHEN REQURED.**

POWER INPUT
MODEL **2005-A-( )-( )-( )-( )-( )-( )-( )-(H)-( )-( )-( )**

OPTION (H)

(1)	115 VAC 50/60 HZ
(2)	220 VAC 50/60 HZ
(*)	10.5 VDC TO 24 VDC - INSERT ACTUAL VOLTAGE **(FOR ANALOG OUTPUT 0-10 VDC & 4-20 MA, THE DC VOLTAGE REQUIRED IS 18-24 VDC)**

ALARMS
MODEL **2005-A-( )-( )-( )-( )-( )-( )-( )-(I)-( )-( )-( )**

OPTION (I)

(HI/LO)	HIGH/LOW - OPEN COLLECTOR
(L)	LOW - SOLID STATE RELAY 24-240 VAC @ 3 AMPS SPST N/O
(H)	HIGH - SOLID STATE RELAY 24-240 VAC @ 3 AMPS SPST N/O
(HL)	HIGH/LOW - SOLID STATE RELAY 24-240 VAC @ 3 AMPS SPST N/O
(L3)	LOW DRY CONTACT
(H3)	HIGH DRY CONTACT
(H/L3)	HIGH/LOW DRY CONTACT

ENCLOSURE STYLE
MODEL **2005-A-( )-( )-( )-( )-( )-( )-( )-( )-(J)-( )-( )**

OPTION (J)

(P)	PANEL MOUNT - SEALED TO NEMA 4X
(ND)	MOUNTED ON DOOR **(SUPPLIED STANDARD WITH THREE ENTRANCE HOLES. IF MORE OR LESS ARE REQUIRED USER MUST SPECIFY.)**
(E)	EXPLOSION-PROOF MEETS NEC CLASS I, GROUPS B, C & D; CLASS II, GROUPS E, F & G; SCA STD C22.2 NO. 30 & NEMA 4

ACCESSORIES/OPTIONS
MODEL **2005-A-( )-( )-( )-( )-( )-( )-( )-( )-( )-(K)-( )**

OPTION (K)

(F)	MOUNTED ON FLOW METER OPTIONS (ND) & (E) ONLY **IF MOUNTED, 'X' RISER ON FLOWMETER IS REQUIRED**
(H)	HEATERS FOR OPTIONS (ND) & (E) ONLY
(MS)	CONNECTORS FOR (ND), INCLUDES MATING CONNECTORS

SPECIAL FEATURES
MODEL **2005-A-( )-( )-( )-( )-( )-( )-( )-( )-( )-( )-(L)**

OPTION (L)

(SP)	ANY SPECIAL FEATURES THAT ARE NOT COVERED IN THE MODEL NUMBER, USE A WRITTEN DESCRIPTION OF THE -SP.

NOTE:
1. INSERT (X) IN MODEL NUMBER FOR EVERY OPTION NOT SPECIFIED.
2. THERE CAN ONLY BE A TOTAL OF (4) OUTPUTS SELECTED FROM THE SCALED DIGITAL OUTPUTS AND ALARM SECTIONS.

1.4 WARRANTY

Hoffer Flow Controls warrants that all equipment will be free from defects in workmanship and material provided that such equipment was properly selected for the service intended, properly installed, and not misused. Equipment which is returned transportation prepaid to Hoffer Flow Controls within 12 months after delivery of goods, or 18 months from date of shipment on equipment for destination outside the United States, and is found by Hoffer Flow Controls inspection to be defective in workmanship or material, will be repaired or replaced at Hoffer Flow Controls' sole option, free of charge and returned shipped using the lowest cost transportation prepaid.

In the event of product failure contact Hoffer Flow Controls at 919-331-1997 or 800-628-4584, for issuance of a **Returned Material Authorization (RMA)** number.

1.5 SHIPPING AND HANDLING

CAUTION - The FLOWSTAR is a static-sensitive devise and standard practice for static sensitive parts should be observed.

In the event of malfunctioning equipment the following guidelines should be observed for the preparation and shipment of the equipment. Failure to do so may result in the material reaching its destination damaged.

The electronic unit due to its **STATIC SENSITIVE** nature should be wrapped in a material conforming to MIL-B-81705 , Type II, and packaged in a heat sealable bag conforming to MIL-P-81997. These steps are necessary to protect the equipment from electrostatic charge(s) that may occur during handling.

The package should then be marked with a sensitive electronic device caution label conforming to MIL-STD-129, Appendix C. The equipment should then be wrapped in cushioning material, and placed into a close fitting box conforming to PPP-B-636 Domestic class.

The exterior shipping container should be marked with a sensitive electronic device caution label conforming to MIL-STD-129, Appendix C.

Clearly mark the factory provided RMA number on all paperwork and shipping packaging.

1.6 ENHANCEMENT FEATURES AND OPTIONS

Many instruments may be used with turbine flowmeters. Few offer the following enhancements for increasing the accuracy of the measurement system.

1.6.1 LINEARIZATION

Many flowmeters are much more repeatable than they are linear. When this is true, as it is in turbine flowmeters, higher measurement accuracy can be achieved by a linearization routine.

Most commonly, higher precision is achieved with the FLOWSTAR by exploiting the repeatability of +/-.05 to +/-.1% over the repeatable flow range. The FLOWSTAR improves linear turbine flow measurement accuracy's to +/-0.1% over 20:1 to 100:1 repeatable flow ranges.

Flowstar can store up to 20 calibration points, for channel 1, and up to 5 points for channels 2 and 3. The unit continuously samples the flowmeter frequency averaged over a programmed period. Stored calibration points are then accessed to determine the closest available calibration information. Using a linear interpolation routine, the actual calibration factor is determined and used in the instrument calculations to achieve the highest possible accuracy.

1.6.2 INSTRUMENT COMMUNICATION OPTIONS

The RS-232 communication port permits many of the desirable, commonly required interface connections to user supplied printers, modems, terminals, and for some computer interfaces. The signals on this port meet or exceed the requirements of RS-232. The 9-pin connector supports the most commonly required handshaking signals. When used with remote computer interface or terminal, the port may be used to request information or to command the Flowstar unit. Most of the capabilities can be controlled from the remote device in a manner similar to the operator panel.

Many requirements arise for the RS422/RS-485(half duplex) communication option. With this port, several instruments may be connected together over greater distances and communicate to a central computer over higher speeds than is possible with the RS-232 communication port. In a multi-drop configuration, the port has a unique feature which permits it to only become active when its corresponding instrument identifier is called.

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2 FLOWSTAR OVERVIEW

2.1 INTRODUCTION

The FLOWSTAR 2005 has two modes of operation, the OPERATING and SETUP modes. This OPERATING mode is used during normal operations. The SETUP mode is used to enter in the calibration parameters of the connected flowmeter. The SETUP mode is also used to configure the operation parameters of the Flowstar during factory and on site customization. The SETUP mode is accessed by proper entry of a password.

Operator input to the Flowstar is by an 20 key membrane keypad. The system displays information on a 2 line by 16 character LCD display.

LED indicator lamps and a sonic alarm are provided. Alarm conditions can be accessed through the communications port using the Hoffer Interface.

2.2 HARDWARE CONFIGURATION OF SOFTWARE OPTIONS

Several fields in both the OPERATION and SETUP modes are dependent on the switch setting of S1. This switch is located on the back of the Flowstar. This switch determines which channels are selected and is only used during power up. Changes after power up to the S1 selector switch have no effect on program operation until a subsequent power up. If a channel is not selected, then its OPERATING and SETUP fields will not be displayed.

The S1 switch block is located on the back side of the PCA-138 PCB The following table details the operation of the S1 switch block.

Table 1 S1 Switch Functions

S1 SWITCH (read left to right)	*FUNCTION*	
	ON/UP	OFF/DOWN
1	***ENGLISH UNITS,***	***METRIC UNITS***
2	ENABLE ANALOG OUTPUT 2(DA2)	INHIBIT ANALOG OUTPUT 2(DA2)
3	ENABLE ANALOG OUTPUT 1(DA1)	INHIBIT ANALOG OUTPUT 2(DA1)
4	ENABLE CHANNEL 3(PRES) INPUT	INHIBIT CHANNEL 3(PRES) INPUT
5	ENABLE CHANNEL 2(TEMP) INPUT	INHIBIT CHANNEL 2(TEMP) INPUT
6	ENABLE LOCAL CONTROL	INHIBIT LOCAL CONTROL
7	***PROGRAM ENABLE***	***PROGRAM LOCKOUT***

2.2.1 Switch S1-7

The PROGRAM ENABLE option determines whether the SETUP mode is available. Turning this switch on enables the MODE key. Turning this switch off prevents entry into the SETUP mode and changing of SETUP parameters using the communication interfaces.

2.2.2 Switch S1-6

The switch enables LOCAL CONTROL of the Flowstar. When system is used via communication set this switch off to disable the START, STOP, CLEAR MAN, AUTO, and REM keys.

2.2.3 Switch S1-5,4

These switches enable or disable their respective analog to digital input channel. If an input channel is turned off, none of its respective setup fields will be available in both the OPERATING and SETUP modes.

2.2.4 Switch S1-3,2

These switches enable or disable respective digital to analog output channel. If an output channel is turned off, none of its respective configuration fields will be available in the SETUP mode.

2.2.5 Switch S1-1

This switch when set to ON enables the display of English units. With S1-1 set to OFF, Flowstar will display in Metric units.

3 OPERATING MODE

3.1 INTRODUCTION

The OPERATING mode is where all measured values are displayed. Displaying a measured value is as simple as pressing a key. In this mode continuous monitoring of all channels are performed. The following display fields are available in the operating mode:

- CH1 TOTAL, direct key selectable by pressing TOTAL..
- CH1 RATE, direct key selectable by pressing RATE.
- CH2(TEMP) , direct key selectable by pressing TEMP1.
- DENSITY , direct key selectable by pressing TEMP2.
- CH3(PRES) , direct key selectable by pressing PRES.
- SETPOINT 1, direct key selectable by pressing SETP1.
- SETPOINT 2, direct key selectable by pressing SETP2.
- AUXILIARY 1, direct key selectable by pressing AUX1.
- AUXILIARY 2, direct key selectable by pressing AUX2.
- TIME/, accessible by LAST and NEXT keys only.
- DATE, accessible by LAST and NEXT keys only.
- CH1 ACCUM, accessible by LAST and NEXT key only.
- CH1 DUAL DISPLAY, direct key selectable by pressing HEAT.
- VISCOSITY, accessible by LAST and NEXT key only.
- AUDIT TRIAL CAL, accessible by LAST and NEXT key only.
- ***AUDIT TRIAL CON, accessible by LAST and NEXT key only.***

NOTE: CH1 DUAL DISPLAY, display both the flowrate and the total for channel 1.

The actual measured value and units displayed for each channel depends on the individual channels configuration selected in the SETUP mode.

3.2 OPERATING MODE KEYBOARD OPERATION

This section details each keys function and response when pressed in the OPERATING mode.

3.2.1 TOTAL, RATE

Selects the display values for the pulsed flow channel 1. Actual display values are dependent on the SETUP configuration for channel 1.

3.2.2 TEMP2

Select the display value for corrected flowing Density. Actual display values are depended the configuration of Flowstar and setting of switch S1-1.

3.2.3 TEMP1, PRES

Select the display values for input channels 2 and 3 respectively. Actual display values are dependent on the SETUP configurations for each channel.

3.2.4 SETP1, SETP2

If TEMP1, or PRES were the previously selected display fields, then their respective alarm set-points will be displayed, else the Flowstar will display CH1 set-points.

3.2.5 CLEAR

The CLEAR key resets channel 1 total to zero unless Ch1 Accum Total is display, then the key will clear CH1 ACCUM TOTAL. Also clears any AUX channel that is configured for total unless CH1 ACCUM TOTAL is displayed.

3.2.6 LAST, NEXT

These keys allow the operator to scroll through the display fields individually. In addition to the key selected fields, there are several miscellaneous fields which can only be viewed by scrolling past the original fields. I.E. TIME, DATE, CH1,

3.2.7 SEL

This key acknowledges an alarm condition. It sets blinking LED's to solid. It will also silence the sonic alarm.

3.2.8 REM

Pressing this key will generate a ticket, when FS-2005 unit is configure for printing and a printer is attached.

3.2.9 MODE

Prompts you for a password. This occurs only if the S1-7 switch is set to ON position during power up. Password entry is facilitated by using the numeric keys. Entry of a proper password will shift the unit into the SETUP mode. Pressing the MODE key while in the SETUP mode will cause the Flowstar unit to switch to the OPERATING mode.

3.3 OPERATING MODE LED AND SONIC ALARM OPERATIONS

During normal operating conditions in which none of the alarm conditions are met, the LED's and SONIC ALARM are in the off state. If an alarm condition is met, then the associated LED will blink and the sonic alarm will sound. This is considered an alarming condition.

To silence the alarm, the SEL key must be pressed. This will cause the sonic alarm to be silenced and the LED will stop blinking and remain in the on condition. This will indicate that an alarming condition is met and that it has been acknowledged. This is the alarm acknowledged state.

If the alarm condition subsides, the LED and sonic alarm(if still on) will deenergize. This is the cleared state. If another alarm condition is met then the same sequence of events will occur. The steady LED on state of a previously acknowledged alarm will remain the same. The alarm conditions are fully configurable in the SETUP mode. When in the SETUP mode all alarm conditions are held in the cleared state

3.4 ERROR MESSAGES

During normal operation the Flowstar 2005 displays various error messages depending on current operating conditions. These error messages indicated phase state of the fluid being measure and transmitter operation status. The error messages are described below:

3.4.1 TEMPERATURE XTMR OVER RANGE

Temperature transmitter Over Range is flashed when ever the Temperature input(ch2) exceeds the maximum allowable input value. The maximum allowable input value depends on the hardware selected and can be 5 vdc, 10 vdc or 20 mA. When Temperature Over Range failure occurs, the system will use the Default Temperature for compensation.

3.4.2 TEMPERATURE SIGNAL LOSS

Temperature Signal Loss is flashed whenever the transmitter output falls below the minimum allowable input or the wiring to the transmitter fails(shorts or open circuit). The minimum allowable input value depends on the hardware selected and can be 0 vdc or 4 mA. When Temperature Signal Loss occurs the system will use the Default Temperature for compensation.

3.4.3 PRESSURE XTMR OVER RANGE

Pressure transmitter Over Range is flashed when ever the Pressure input(ch3) exceeds the maximum allowable input value. The maximum allowable input value depends on the hardware selected and can be 5 vdc, 10 vdc or 20 mA. When Pressure Xtmr Over Range failure occurs, the system will use the Default Pressure for compensation.

3.4.4 PRESSURE SIGNAL LOSS

Pressure Signal Loss is flashed whenever the pressure transmitter output falls below the minimum allowable input or the wiring to the transmitter fails(shorts or open circuit). The minimum allowable input value depends on the hardware selected and can be 0 vdc or 4 mA. When Pressure Signal Loss occurs the system will use the Default Pressure for compensation.

3.4.5 TOTALING STOPPED GAS INHIBIT

Totaling Stopped Gas Inhibit is flashed whenever gas is detected in the fluid being measured. The Flowstar 2005 does not detect the presence of gas directly. Gas detection is based upon entered values in the Fluid Properties Table and the current Temperature and Pressure. When ever the flowing pressure of the fluid drops below the value of the Saturated Pressure @ Temperature, the Gas Inhibit message is displayed and totaling is inhibited.

3.4.6 TWO PHASE WARNING

Two Phase Warning is flashed whenever the flowing pressure is within 25 PSIA of the linearized Saturated Pressure @ Temperature. This error message is disabled when Gas Inhibit occurs.

3.4.7 COMP RANGE OUT

This error message is displayed whenever process input variables(temperature and pressure) exceeds the programmed temperature and pressure ranges of the Fluid Properties Table.

3.4.8 PRINTER IS OFF LINE

Printer is Off Line is displayed whenever a connected printer is "Out of Paper" or is "Off Line." If a printer does not support "Paper Out" detection, then Flowstar will not be able to detect a Paper Out error. Check you printer documentation. Hoffer Flow Controls sells a special cable for connecting a serial printer to the Flowstar.

In order for a serial printer to be used with the Flowstar, it must support the ASCII(IBM) character table and be RS232C compatible.

3.4.9 STOP FLOW

If an attempt is made to print a ticket when the Flowstar is configured for a printer and flow is present, then "Stop Flow" error message will be flashed.

4 SETUP MODE OPERATIONS

4.1 INTRODUCTION

After the MODE key is pressed in the OPERATING mode, a password entry screen is displayed. Enter the proper password and press the MODE key, the Flowstar will enter the SETUP mode. After configuration and calibration parameters have been entered or viewed, press the MODE key once more to return to the OPERATING mode. If the SETUP mode is entered, the last item selected will be displayed again. The default password is 2001.

4.2 KEYBOARD OPERATION

The FS 2005 uses an alternate key functionality when in the SETUP modes.

4.2.1 1, 2, 3, 4, 5, 6, 7, 8, 9 and 0

These keys facilitate numeric entry in selected SETUP fields.

4.2.2 SEL, REM

Changes a selected SETUP fields discrete selection.

4.2.3 LAST, NEXT

Scrolls forward and backwards through the SETUP fields.

4.2.4 STOP

Changes the sign of floating point number(i.e. Default Temperature, CH2 MPs, etc.).

4.2.5 MAN, and AUTO

Perform no functions in this mode, except where noted.

4.2.6 MODE

When pressed causes the program to exit the SETUP mode. Any altered values are stored in non volatile memory(EEPROM).

4.3 SETUP MODE FIELD DESCRIPTIONS

Many of the field selections in the SETUP modes are optional and are dependent on the S1 setup switch. If the specific channel selector switch is not enabled then all of the configuration/calibration fields for that channel will not be displayed.

4.3.1 FLUID TYPE

Selects the Fluid that is being delivered. Select from the following. Fluid Type setting does not effect the calculation accuracy of the Flowstar.

- GENERIC
- LIN
- LOX
- LAR
- LH2

4.3.2 COMP METHOD

The Flowstar 2005 system perform density calculations based on the setting of Compensation Method. Select from MANUAL TEMPERATURE, or TEMP & PRES. When Compensation Method is set to Manual the Flowstar system will use Default Density. When set to either TEMPERATURE or TEMP & PRES the Flowstar system uses the data enter in the Fluid Properties tables to calculate the density.

4.3.3 GAS INHIBIT

This settings enables or inhibits the GAS INHIBIT feature of the FLOWSTAR 2005. When the GAS INHIBIT error occurs, totaling will be inhibited. Select from:

- OFF
- ON

The default is OFF.

4.3.4 CH1 TOT CONFIG

This field is used to assign display measured values in the TOTAL display, for the pulsed flow input channel. The following units and options are available.

English Units	*Metric Units*
LBS	KG
FT^3	M3
GAL	LIT
OZ	GR
FLOZ	CC
PTS	MLIT
BBL	VOID
TON	MTON
UDEF	UDEF

4.3.5 CH1 RATE CONFIG:

This field is used to assign display measured values in the RATE display based off the pulsed flow input channel. The following units and options are available.

English Units	*Metric Units*
LBS/MIN	KG/MIN
LBS/HR	KG/HR
LBS/SEC	KG/SEC
FT^3/MIN	M^3/MIN
FT^3/HR	M^3/HR
FT^3/SEC	M^3/SEC
GAL/MIN	LIT/MIN
GAL/HR	LTI/HR
GAL/SEC	LIT/SEC
OZ/MIN	GR/MIN
OZ/HR	GR/HR
OZ/SEC	GR/SEC
FLOZ/MIN	CC/MIN
FLOZ/HR	CC/HR
FLOZ/SEC	CC/SEC
PTS/MIN	MLIT/MIN
PTS/HR	MLIT/HR
PTS/SEC	MLIT/SEC
BBL/MIN	VOID
BBL/HR	VOID
BBL/SEC	VOID
TON/MIN	MTON/MIN
TON/HR	MTON/HR
TON/SEC	MTON/SEC
UDEF/MIN	UDEF/MIN
UDEF/HR	UDEF/HR
UDEF/SEC	UDEF/SEC

4.3.6 TEMP UNITS

This selection determines the units of measure used to enter and display all temperature related entries. The Flowstar uses DEG K as its base temperature unit. All temperature entries are converted to the base unit for storage. The Flowstar uses the base temperature unit to perform all temperature related calculation. The base unit values are converted back into the selected unit for display and communication accesses. Select from the following.

- DEG K
- DEG F
- DEG C
- DEG R

4.3.7 PRESSURE UNITS

This selection determines the units of measure used to enter and display all pressure related entries. The Flowstar uses PSIA as its base pressure unit. All pressure entries are converted to the base unit for storage. The Flowstar uses the base pressure unit to perform all pressure related calculations. The base unit values are converted back to the selected unit for display and communication accesses. Select from the following.

- PSIA
- PSIG
- ATM
- BAR-A
- BAR-G
- KPAS-A
- KPAS-G

4.3.8 CH1 DATA ATIME

Channel 1 Data Average Time is the amount of time that the displayed rate indication is averaged. A value of 0.3 second will mean that no data averaging will occur. Enter a numeric value from 0.25 to 10.0 seconds. The default value for CH1 DATA ATIME is 1 second.

4.3.9 CH1 POINT NUMBER

This integer field determines how many points will be used in a linearization lookup table. Allowed values are from 0 to 20. Default value is 20.

4.3.10 C1 PULSE WEIGHT

Enter a value which corresponds to the pulses per unit of measure selected on the channels display field. For example, 1.00 will represent 1 pulse/unit, 10 will equal 10 pulses/unit, and 0.1 will equal 1 pulse per 10 units. Default value is 1.00. This setting is only valid when RELAY X CONFIG(where X can be 1 or 2) is set to FWD SCALED PULSE or REV SCALED PULSE.

4.3.11 FLOW CALC METHOD

Select from the following based on the type of measurement calculation desired.

- SINGLE KFACTOR, uses DEF K
- KFACTOR
- TEMP vsVISCOSITY
- FWD REV KFACTOR
- F/R TEMP vsVISCO

4.3.12 DEF TEMP UNIT

This is the temperature used to provide compensation when channel 2 fails or is turned off. Default Temperature unit is depended on setting of TEMP UNITS. Default value is 70 °F(294.26 °K).

4.3.13 DEF PRES UNIT

This is the pressure used to compensate liquids to conditions when channel 3 fails or is turned off. Default Pressure unit is depended on the setting of PRESSURE UNIT. Default value is 185.3 PSIG(200.0 PSIA)..

4.3.14 DEF DENS LBS/GAL or KG/LIT

This is the default density used to convert volume units to mass units when COMP METHOD is set to MANUAL. The Default Density unit is dependent on the setting of switch S1-1. Default is 8.3316 LB/GAL.

4.3.15 B DENS LBS/GAL or KG/LIT

This is the base density used to convert mass units back into volume units. Base Density is usually expressed at standard conditions. The Base Density unit is dependent on setting of S1-1. Default value is 8.3316 LB/GAL.

4.3.16 DEF K P/GAL or P/LIT

This is the default K Factor which will be used when the FLOW CALC METHOD is selected to SINGLE KFACTOR. Unit is depended on the setting of switch S1-1.

4.3.17 USER GAL TO UDEF or USER LIT TO UDEF

This field is used when the channel 1 total or rate are configured for user's defined units. Enter a value that when multiplied by gallons or liters will give the user the proper units. The unit used is dependent on the setting of switch S1-1.

The display of the HZ, HZ/CSTK, and KFACTOR entries are depended on the setting of FLOW CALC METHOD and CH1 POINT NUMBER.

4.3.18 FREQ HZ 1-20 or FWD FREQ HZ 1-20

FREQUENCY 1 through 20 are the flow meter characteristics used for the forward flow input channel when the KFACTOR or FWD REV KFACTOR method is selected for the FLOW CALC METHOD. Enter in a floating point value. These values are displayed when FLOW CALC METHOD is set to K-FACTOR or FWD REV KFACTOR.

4.3.19 KFAC P/GAL 1-20, KFAC P/LIT 1-20, FWD KFAC P/GAL 1-20, or FWD KFAC P/LIT 1-20

K FACTOR 1 through 20 are the forward flow meter characteristics used for the flow input channel when the KFACTOR or FWD REV KFACTOR method is selected for the FLOW CALC METHOD. Enter in a floating point value. Units are depended on the setting of switch S1-1. These values are displayed when FLOW CALC METHOD is set to K-FACTOR or FWD REV KFACTOR.

4.3.20 REV FREQ HZ 1-20

REVERSE FREQUENCY 1 through 20 are the reverse flow meter characteristics used for the flow input channel when the FWD REV KFACTOR method is selected for the FLOW CALC METHOD. Enter in a floating point value. These values are displayed when FLOW CALC METHOD is set to FWD REV KFACTOR.

4.3.21 REV KFAC P/GAL 1-20, or REV KFAC P/LIT 1-20

REVERSE KFACTOR 1 through 20 are the reverse flow meter characteristics used for the flow input channel when the FWD REV KFACTOR method is selected for the FLOW CALC METHOD. Enter in a floating point value. Units are depended on the setting of switch S1-1. These values are displayed when FLOW CALC METHOD is set to FWD REV KFACTOR.

4.3.22 HZ/CSTK 1-20 or FWD HZ/CSTK 1-20

HZ/CSTK 1 through 20 are the forward flow, flowmeter characteristics used for the flow input channel when the TEMP vsVISCOSITY or F/.R TEMP vsVISCO method is selected for the FLOW CALC METHOD. Enter in a floating point value. These values are displayed when FLOW CALC METHOD is set to TEMP vsVISCOSITY or F/.R TEMP vsVISCO.

4.3.23 KFAC P/GAL, KFAC P/LIT 1-20, FWD KFAC P/GAL, or FWD KFAC P/LIT 1-20

These K-FACTORs are used when FLOW CALC METHOD is set to TEMP vsVISCOSITY. Enter in a floating point value. Units are depended on the setting of switch S1-1. These values are displayed when FLOW CALC METHOD is set to TEMP vsVISCOSITY or F/.R TEMP vsVISCO.

4.3.24 REV HZ/CSTK 1-20

REV HZ/CSTK 1 through 20 are the reverse flow, flowmeter characteristics used for the flow input channel when the F/R TEMP vsVISCO method is selected for the FLOW CALC METHOD. Enter in a floating point value. These values are displayed when FLOW CALC METHOD is set to F/.R TEMP vsVISCO.

4.3.25 REV KFAC P/LIT 1-20

These K-FACTORs are used for reverse flow when FLOW CALC METHOD is set to F/R TEMP vsVISCO. Enter in a floating point value. Units are depended on the setting of switch S1-1. These values are displayed when FLOW CALC METHOD is set to F/.R TEMP vsVISCO.

4.3.26 ATD DATA ATIME

ATD Data Averaging Time is the amount of time that the displayed values for Temperature and Pressure are averaged Enter a numeric value from 0.1 to 10.0 seconds. The default value for ATD DATA ATIME is 0.5 seconds. A setting of 0.1 second means that no data averaging will occur. Default value is 5 seconds.

NOTE: If channel 2 is disabled by S1-5 being turned OFF, then all of the channel 2 settings will not be displayed.

4.3.27 CH2 LOW CAL

This field is used to calibrate the channels low end. Set the channels input to its lowest value(1 volt or 4 mA) and press the SEL key. This locks in the low point corresponding to the lowest selected table entry.

4.3.28 CH2 HIGH CAL

This field is used to calibrate the channels high end. Set the channels input to its highest value(5 volt or 20 mA) and press the SEL key. This locks in the high point corresponding to the highest selected table entry.

4.3.29 CH2 MP UNIT 1-2

These values are used to determine the measured value used in channel 2. The units used to program CH2 MEASUREMENT POINT are determined by the setting of Temperature Unit.

NOTE: If channel 3 is disabled by S1-4 being turned OFF, then all of the channel 3 settings will not be displayed.

4.3.30 CH3 LOW CAL

This field is used to calibrate the channels low end. Set the channels input to its lowest value(1 volt or 4mA) and press the SEL key. This locks in the low point corresponding to the lowest selected table entry.

4.3.31 CH3 HIGH CAL

This field is used to calibrate the channels high end. Set the channels input to its highest value(5 volts or 20 mA) and press the SEL key. This locks in the high point corresponding to the highest selected table entry.

4.3.32 CH3 MP UNIT 1-2

These values are used to determine the measured value used in channel 3. The units used to program CH3 Measurement Points are determine by the setting of Pressure Unit. For proper operation, both of the measurement points must be specified.

The display of the Fluid Property Table entries are depended on the settings of COMP METHOD, FLOW CALC METHOD and FLUID TABLE PT. If COMP METHOD is set to MANUAL and FLOW CALC METHOD is not set to TEMP vsVISCOSITY or F/R TEMP vs VISCO, then none of the Fluid Property Table entries will be displayed. If COMP METHOD is set to TEMP or TEMP & PRES then FLUID TABLE PT, FLUID MAX PRES, TEMP UNIT 1-20, PSAT 1-20, DSAT 1-20, and DCP 1-20 entries will be displayed. If FLOW CALC METHOD is set to TEMP vsVISCOSITY or F/R TEMP vsVISCO, then FLUID TABLE PT, TEMP 1-20, and VISCOSITY 1-20 entries will be displayed. NOTE: The number of entrées displayed are depended on the setting of FLUID TABLE PT.

4.3.33 FLUID TABLE PT

This numeric field determines the number of points used in the Fluid Properties tables. Enter a integer number from 2 to 20.

4.3.34 FLUID MAX PRES

Enter in the floating point number that corresponds to the DENS @ T & HP(Fluid Temperature and Maximum Pressure) table entries. Units for Fluid Maximum Pressure are determine by the Pressure Unit setting.

4.3.35 TEMP UNIT 1-20

Fluid Temperature Range 1 through 20 are the fluid properties temperature indexes. The system well determine the interpolation points of the fluid properties table from the Temperature table. The units for temperature are determine by the setting of Temperature Units.

4.3.36 PSAT PRESSURE UNITS 1-20

Saturated Pressure at Temperature 1 through 20 are the fluid properties Saturated Pressure at the programmed temperature indexes. Enter a floating point number corresponding to the temperature entries in FLUID TEMP 1-20. Units for PSAT @ TEMP are determined by the setting of PRESSURE UNITS. PSAT is displayed when ever COMP METHOD is not set to MANUAL

4.3.37 DSAT DENSITY UNITS 1-20

Saturated Density at Temperature and Saturated Pressure 1 through 20 are the fluid properties Density at programmed temperature indexes and program saturated pressure. Enter a floating point number corresponding to the temperature entries in FLUID TEMP 1-20. Units for DSAT @ T & SP are determined by the setting of S1-1. DSAT is display when COMP METHOD is set to either TEMP or TEMP & PRESS

4.3.38 DCMP DENSITY UNITS 1-20

Compressed Density corresponding to Fluid Temperature and Maximum Pressure. Enter floating point number corresponding to the Compressed Density at the indexed programmed temperature and high pressure. The units for DCP are determine by switch setting of S1-1.

4.3.39 VISCOSITY 1-20

VISCOSTIY 1-20 corresponds to the fluid viscosity at indexed temperature range of the fluid properties table. Enter floating point values. VISCOSITY 1-20 are displayed when FLOW CALC METHOD is set to TEMP vsVISCOSITY or F/R TEMP vsVISCO.

4.3.40 AUX 1 UNITS AND AUX 2 UNITS

This selection set the units to be used when the AUX 1 or AUX 2 key is depressed in the OPERATING mode.

Total units available on the Auxiliary displays.

English Units	*Metric Units*
LBS	KG
FT^3	M3
GAL	LIT
OZ	GR
FLOZ	CC
PTS	MLIT
BBL	VOID
TON	MTON
UDEF	UDEF

4.3.41 Rate units available on the Auxiliary displays

English Units	*Metric Units*
LBS/MIN	KG/MIN
LBS/HR	KG/HR
LBS/SEC	KG/SEC
FT^3/MIN	M^3/MIN
FT^3/HR	M^3/HR
FT^3/SEC	M^3/SEC
GAL/MIN	LIT/MIN
GAL/HR	LTI/HR
GAL/SEC	LIT/SEC
OZ/MIN	GR/MIN
OZ/HR	GR/HR
OZ/SEC	GR/SEC
FLOZ/MIN	CC/MIN
FLOZ/HR	CC/HR
FLOZ/SEC	CC/SEC
PTS/MIN	MLIT/MIN
PTS/HR	MLIT/HR
PTS/SEC	MLIT/SEC
BBL/MIN	VOID
BBL/HR	VOID
BBL/SEC	VOID
TON/MIN	MTON/MIN
TON/HR	MTON/HR
TON/SEC	MTON/SEC
UDEF/MIN	UDEF/MIN
UDEF/HR	UDEF/HR
UDEF/SEC	UDEF/SEC

Conversion units available on the Auxiliary displays.

English Units	*Metric Units*
KG	LBS
M^3	FT^3
LIT	GAL
KG/MIN	LBS/MIN
M^3/MIN	$FT^{3/}$MIN
LIT/MIN	GAL/MIN

4.3.42 ALM1 S-H RATE UNIT

This field sets the high alarm set-point for channel 1. If a high alarm is not desired set it to a known condition well above the operating range of the measured value. Enter a floating point number. Default is 200.00.

4.3.43 ALM1 S-L RATE UNIT

This field sets the low alarm set-point for channel 1. Enter a floating point number. Default is 0.00.

4.3.44 ALM1 DBA RATE UNIT

This field sets the deadband for the channel 1 alarms. To inhibit the high alarm, the measured value must fall below the high alarm set-point minus the deadband value. To inhibit the low alarm, the measured values must rise above the low alarm set-point plus the deadband value. The deadband reduces spurious alarms when close to the set points.

If channel 1 flow rate units are change after the programming of the Alarm 1 settings, then the Alarm 1 settings will have to be reprogrammed to the new flow rate units.

4.3.45 ALARM 1 AUDIBLE

This selects the condition for the channel 1 audible sonic alarm. Select from the following.

- OFF
- HIGH ONLY
- LOW ONLY
- HIGH AND LOW

NOTE: If channel 2 is disabled by S1-5 being turned OFF, then all of the channel 2 settings will not be displayed.

4.3.46 ALM2 S-HI TEMP UNIT

This field sets the high alarm set-point for channel 2. If a high alarm is not desired set it to a known condition well above the operating range of the measured value. Enter a floating point number. Default is 70 °F(296.26 °K).

4.3.47 ALM2 S- LO TEMP UNIT

This field sets the low alarm set-point for channel 2. Enter a floating point number. Default is 0.00.

4.3.48 ALM2 DBAN TEMP UNIT

This field sets the deadband for the channel 2 alarm. To inhibit the high alarm, the measured value must fall below the high alarm set-point minus the deadband value. To inhibit the low alarm, the measured values must rise above the low alarm set-point plus the deadband value. The deadband reduces spurious alarms when close to the set points.

4.3.49 ALARM 2 AUDIBLE

This selects the condition for the channel 2 audible sonic alarm. Select from the following.

- OFF
- HIGH ONLY
- LOW ONLY
- HIGH AND LOW

NOTE: If channel 3 is disabled by S1-4 being turned OFF, then all of the channel 3 settings will not be displayed

4.3.50 ALM3 S-HI PRES UNIT

This field sets the high alarm set-point for channel 3. If a high alarm is not desired, set it to a known condition well above the operating range of the measured value. Enter a floating point number. Default is 185.3 PSIG(200.0 PSIA).

4.3.51 ALM3 S-LO PRES UNIT

This field sets the low alarm set-point for channel 3. Enter a floating point number. Default is 0.00.

4.3.52 ALM3 DBAN PRES UNIT

This field sets the deadband for the channel 3 alarms. To inhibit the high alarm, the measured value must fall below the high alarm set-point minus the deadband value. To inhibit the low alarm, the measured values must rise above the low alarm set-point plus the deadband value. The deadband reduces spurious alarms when close to the set points.

4.3.53 ALARM 3 AUDIBLE

This selects the condition for the channel 3 audible sonic alarm. Select from the following.

- OFF
- HIGH ONLY
- LOW ONLY
- HIGH AND LOW

If S1-3 is set to off, then the settings for Digital to Analog Channel 1 will not be displayed. .

4.3.54 DA1 CONFIG

This field select the mode of operation for the digital to analog output channel 1. Select from the following.

- MIMIC CH1: used to configure the analog output to mimic CH1 rate.
- MIMIC CH2: used to configure the analog output to mimic CH2 temperature.
- MIMIC CH3: used to configure the analog output to mimic CH3 pressure.
- MIMIC CH1 FWD/REV: used to configure the analog output to mimic forward and reverse flow.

When DA1 CONFIG is set to MIMIC CH1 rate and CH1 RATE CONFIG units are changed after programming of the DA output channels then the DA output minimum and maximum values will have to be reprogrammed.

4.3.55 DA1 MIN UNIT

Enter a floating value that corresponds to the minimum value expected on the selected mimic channel. This value will correlate to 0 volts or 4 mA output depending on the hardware selected. Unit is determine by the mimic channel's selected unit.

4.3.56 DA1 MAX UNIT

Enter a floating value that corresponds to the maximum value expected on the selected mimic channel. This value will correlate to 5 volts, 10 volts, or 20 mA output depending on the hardware selected. Unit is determine by the mimic channel's selected unit.

If S1-2 is set to off, then the settings for Digital to Analog Channel 2 will not be displayed. .

4.3.57 DA2 CONFIG

This field select the mode of operation for the digital to analog output channel 2. Select from the following.

- MIMIC CH1: used to configure the analog output to mimic CH1 rate.
- MIMIC CH2: used to configure the analog output to mimic CH2 temperature.
- MIMIC CH3: used to configure the analog output to mimic CH3 pressure.
- MIMIC CH1 FWD/REV: used to configure the analog output to mimic forward and reverse flow.

When DA2 CONFIG is set to MIMIC CH1 rate and CH1 RATE CONFIG units are changed after programming of the DA output channels then the DA output minimum and maximum values will have to be reprogrammed.

4.3.58 DA2 MIN UNIT

Enter a floating value that corresponds to the minimum value expected on the selected mimic channel. This value will correlate to 0 volts or 4 mA output depending on the hardware selected. Unit is determine by the mimic channel's selected unit.

4.3.59 DA2 MAX UNIT

Enter a floating value that corresponds to the maximum value expected on the selected mimic channel. This value will correlate to 5 volts, 10 volts, or 20 mA output depending on the hardware selected. Unit is determine by the mimic channel's selected unit.

4.3.60 RELAY 1-2 CONFIG

Each relay can have the following selections:

- ALARM HIGH FLOW RATE
- ALARM1 LOW FLOW RATE
- ALARM2 TEMP OVER RANGE
- ALARM2 LOW TEMP
- ALARM3 PRES OVER RANGE
- ALARM3 LOW PRES
- ALARM AUDIBLE This will occur based on the conditions that the audible alarm are set to.
- FWD SCALED PULSE, select this item if a forward scaled pulsed output is desired.
- REV SCALED PULSE, select this item if a reverse scaled pulsed output is desired.
- PUMP INTERLOCK, programs relay to function as pump interlock.

4.3.61 RELAY 3-4 CONFIG

Each relay can have the following selections:

- ALARM HIGH FLOW RATE
- ALARM1 LOW FLOW RATE
- ALARM2 TEMP OVER RANGE
- ALARM2 LOW TEMP
- ALARM3 PRES OVER RANGE
- ALARM3 LOW PRES
- ALARM AUDIBLE
  This will occur based on the conditions that the audible alarm are set to.
- PUMP INTERLOCK, programs relay to function as pump interlock.

4.3.62 SERIAL MODE

Select the serial communications mode from the following.

- RS232
- RS422
- RS485

4.3.63 RS-485 NODE NUM

RS-485 multi-drop communications requires a unique identifier for the unit. Enter in an integer for this field in the range of 0 to 31.

4.3.64 BAUD RATE

Select one of the following to determine the serial baud rate.

- 9600
- 4800
- 2400
- 1200
- 600
- 300
- 150
- 75

4.3.65 HANDSHAKE

Select one of the following to set the serial handshake method.

- NONE: Recommended standard.
- HARDWARE DTR: Jumper CTS to DTR on Flowstar's DB-9 connector. If this jumper is not place on the Flowstar when HARDWARE DTR is selected, then the system will perform a *Continuous Reset*. As soon as the jumper is attached or the system is connected to a Master Computer/Adapter(with the proper DTR support), the system will return to normal operation. NOTE: Flowstar 2005 firmware version 1.02 does not required the jumper for proper operation.
- XON/XOFF

4.3.66 SERIAL PROTOCOL

Determine the communication mode based on the hardware. Select one of the following.

- REMOTE KEYBOARD
- HFC-5A INTERFACE
- PRINTER 2010(Hoffer's mini printer)
- PRINTER

4.3.67 PASSWORD

This field allows the password to be changed from the factory default of 2001.

4.3.68 DATE

Enter the date using the numeric keys.

4.3.69 DAY OF THE WEEK

Select from one of the following fields.

- MON
- TUE
- WED
- THU
- FRI
- SAT
- SUN

4.3.70 TIME 24-HOUR CLK

Set the time of day in 24 hour mode.

4.3.71 RESTORE NEW UNIT

NOTE: Complete calibration is loss if Flowstar is restored.

To restore the unit to factory defaults, perform the following steps:

1. Press the SEL key, the unit will display PASSWORD entry field.
2. Enter password.
3. Press MODE key, if correct password is entered then the unit will display RESTORING TO FACTORY DEFAULTS. If the incorrect password is entered, the display will return to RESTORE NEW UNIT.

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5 INSTALLATION

5.1 INSTALLATION WIRING LAYOUT FOR INTERCONNECTIONS

In considering the interconnections between the flowmeter and the flow measurement system, some attention must be given to anticipated noise sources and to the coupling of these noise sources to the interconnecting wiring.

Noise signals may be coupled inductively or capacitively into the wiring between the sensor and the electronic measuring systems. In general, utilizing a shielded, twisted pair for the interconnection greatly reduces this coupling. The shield should be grounded on one end of the cable only. In general, grounding only on the electronic measuring system is best.

However, even with proper interconnecting cabling cross talk with other signal lines or power lines may still occur and should be avoided. Physical isolation of the wiring reduces the chance of potential problems.

5.2 INSTALLATION OF THE FLOWSTAR

FLOWSTAR should be placed in a convenient location, which maintains access to the unit should repairs or readjustment be required.

Refer to following installation diagrams for proper connections of input power, process sensors, process output and control outputs.

Figure 5.1 RS-232/RS-422/RS-485 Wiring Detail

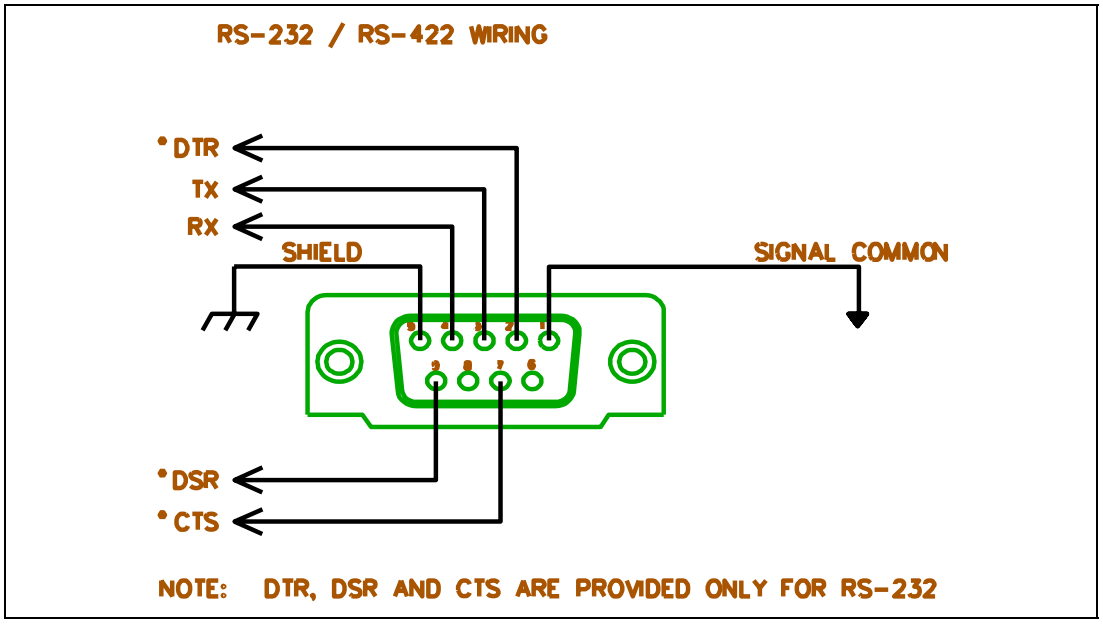


Figure 5.2 AC Power Input

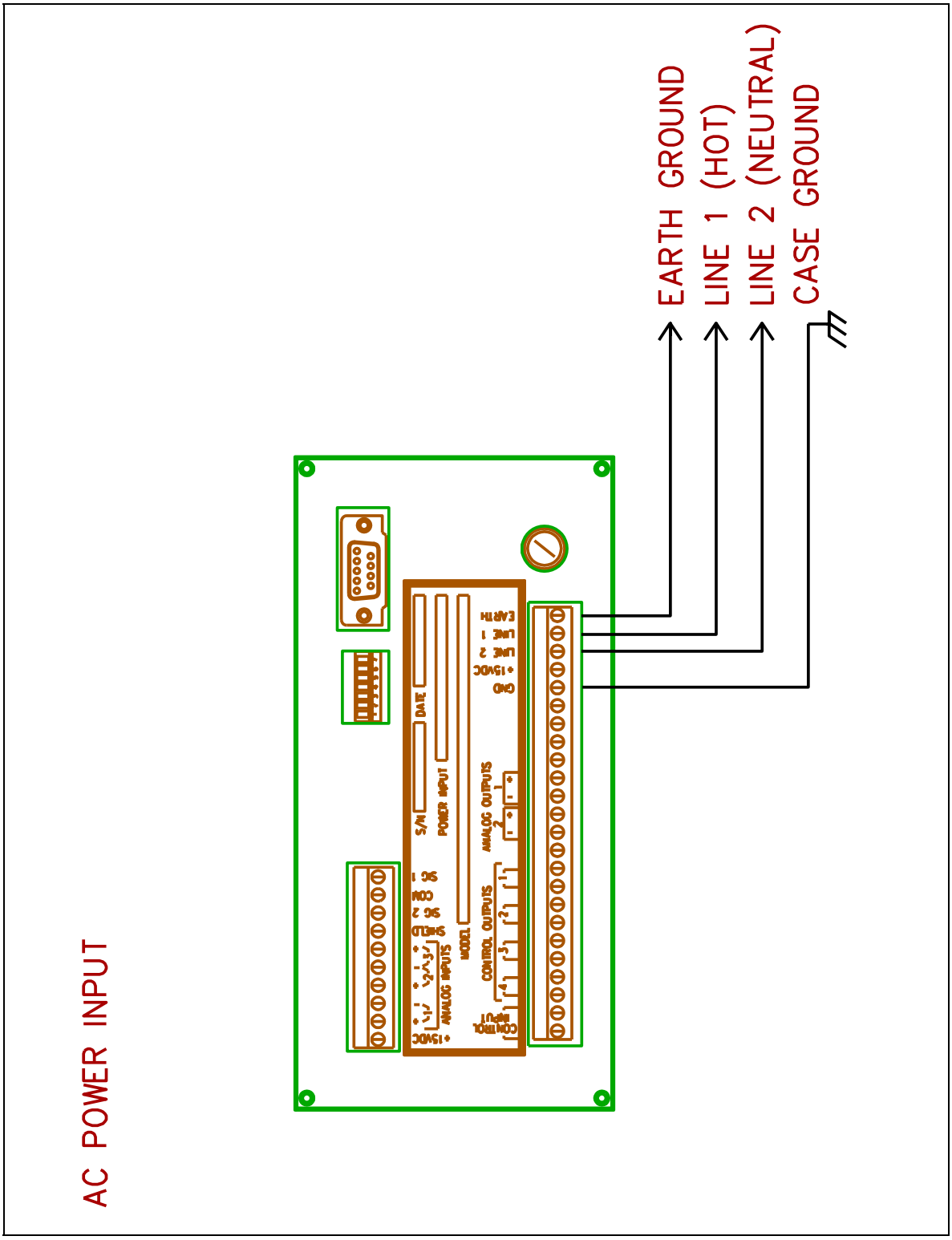


Figure 5.3 DC Power Input

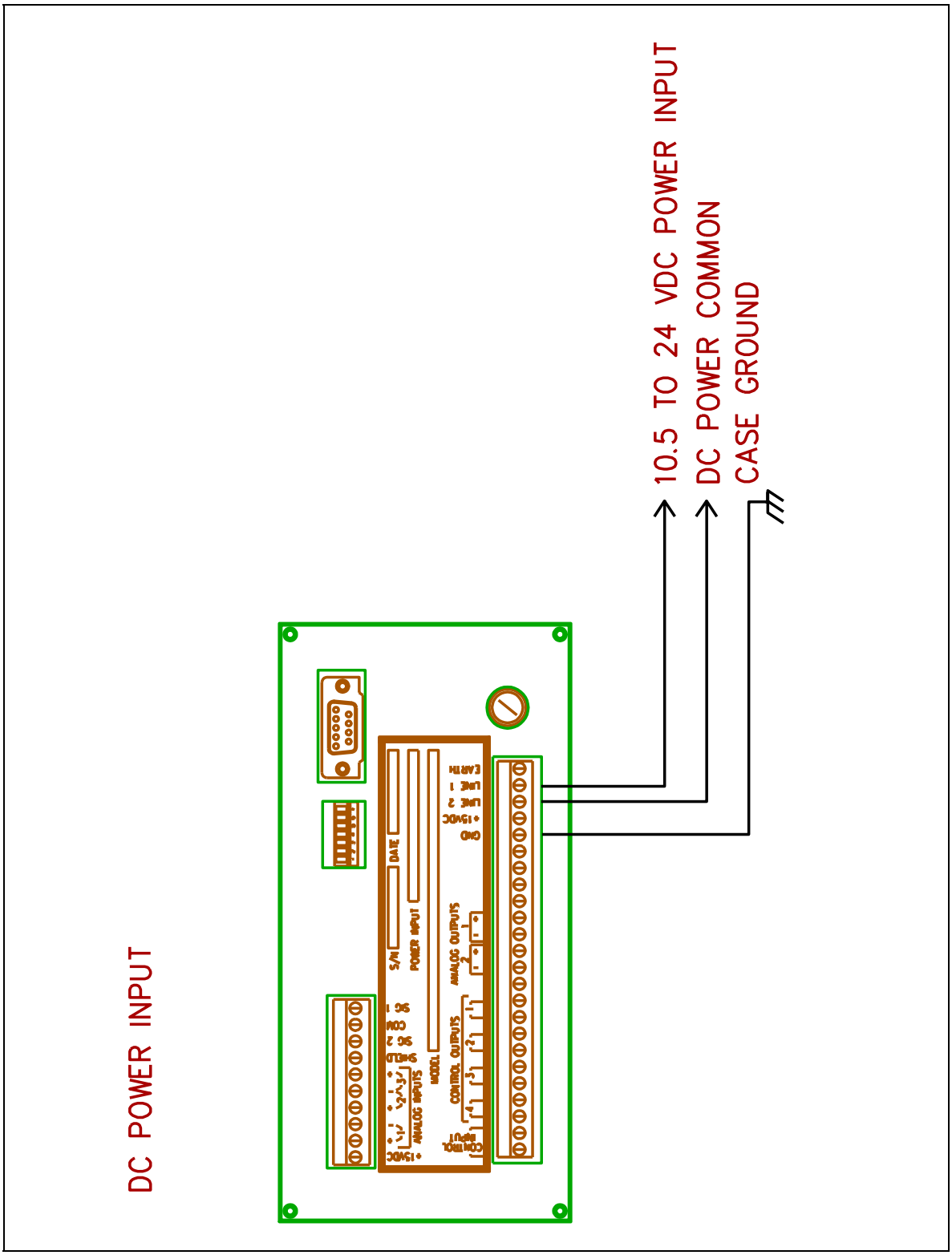


Figure 5.4 Single Magnetic Pickup Input

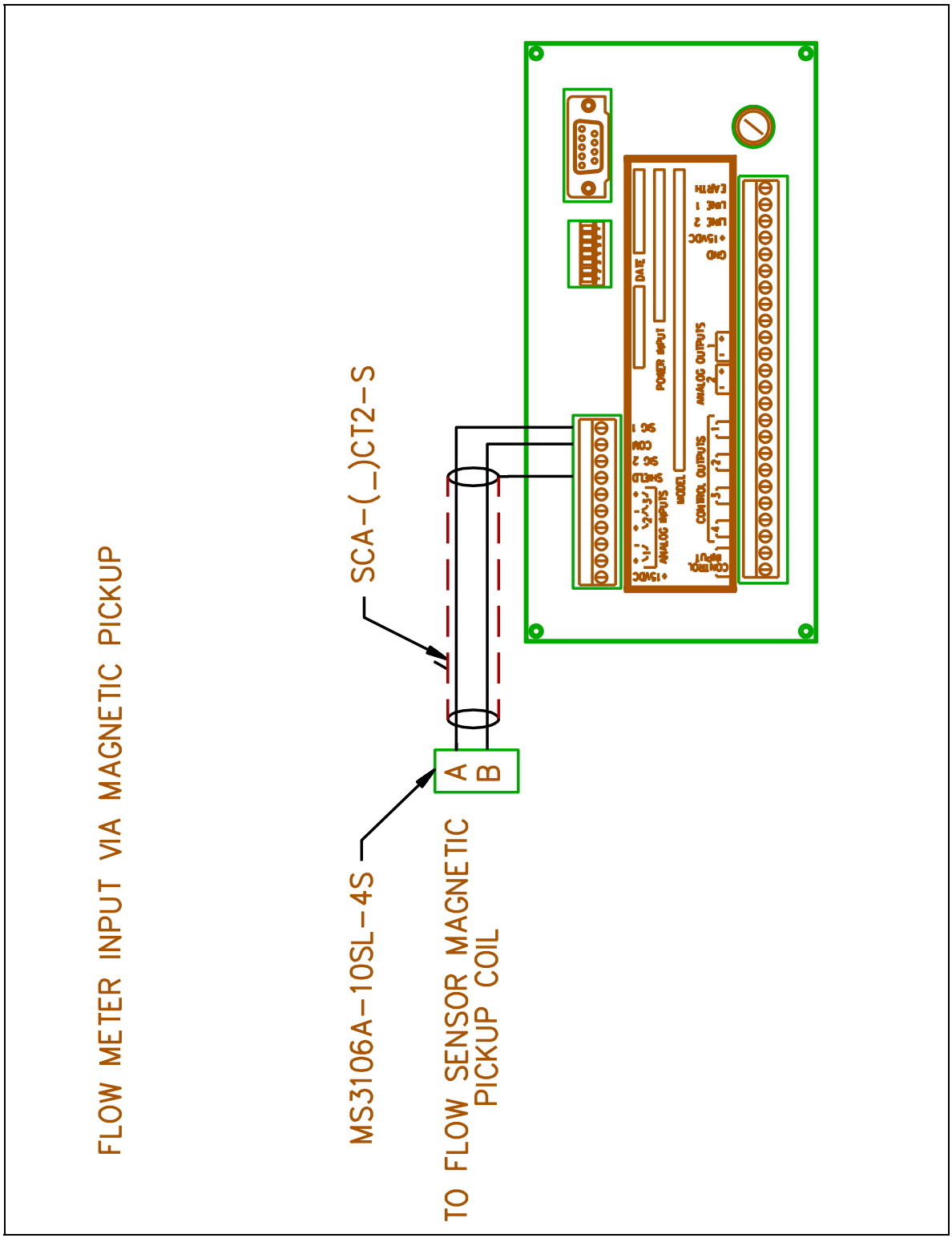


Figure 5.5 Quadrature Magnetic Pickup Input

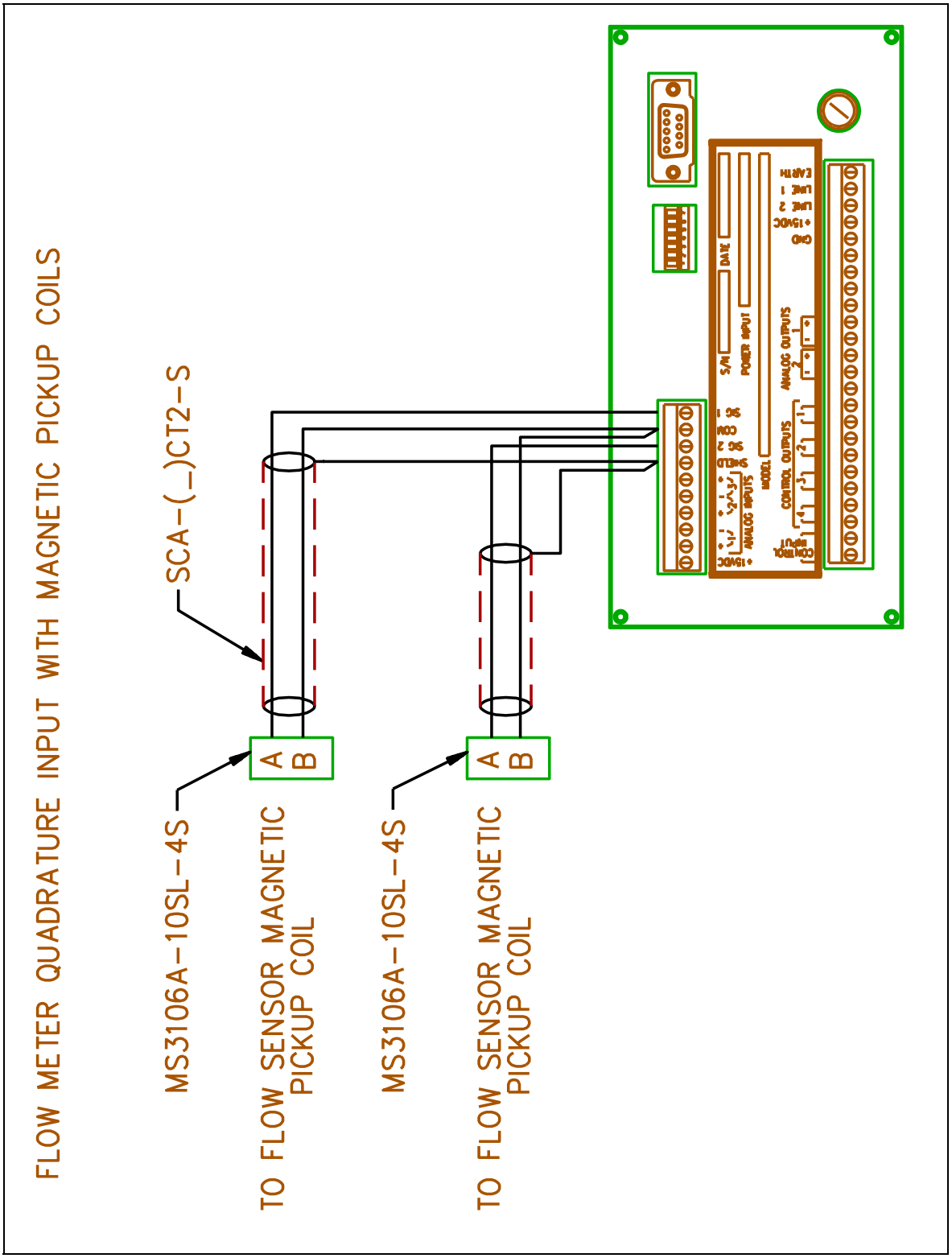


Figure 5.6 MCP Pickup Coil Input

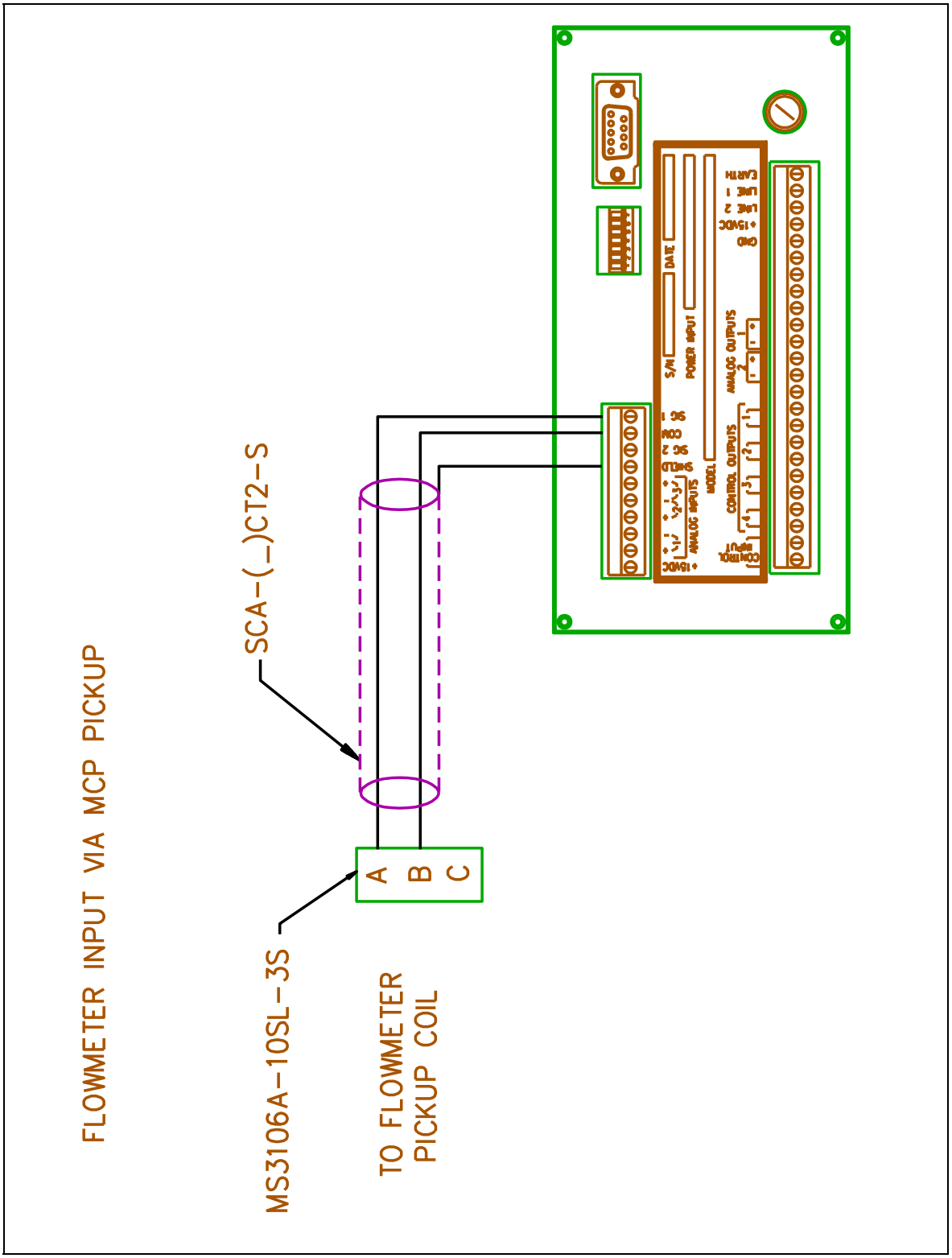


Figure 5.7 Remote Signal Conditioner Interface

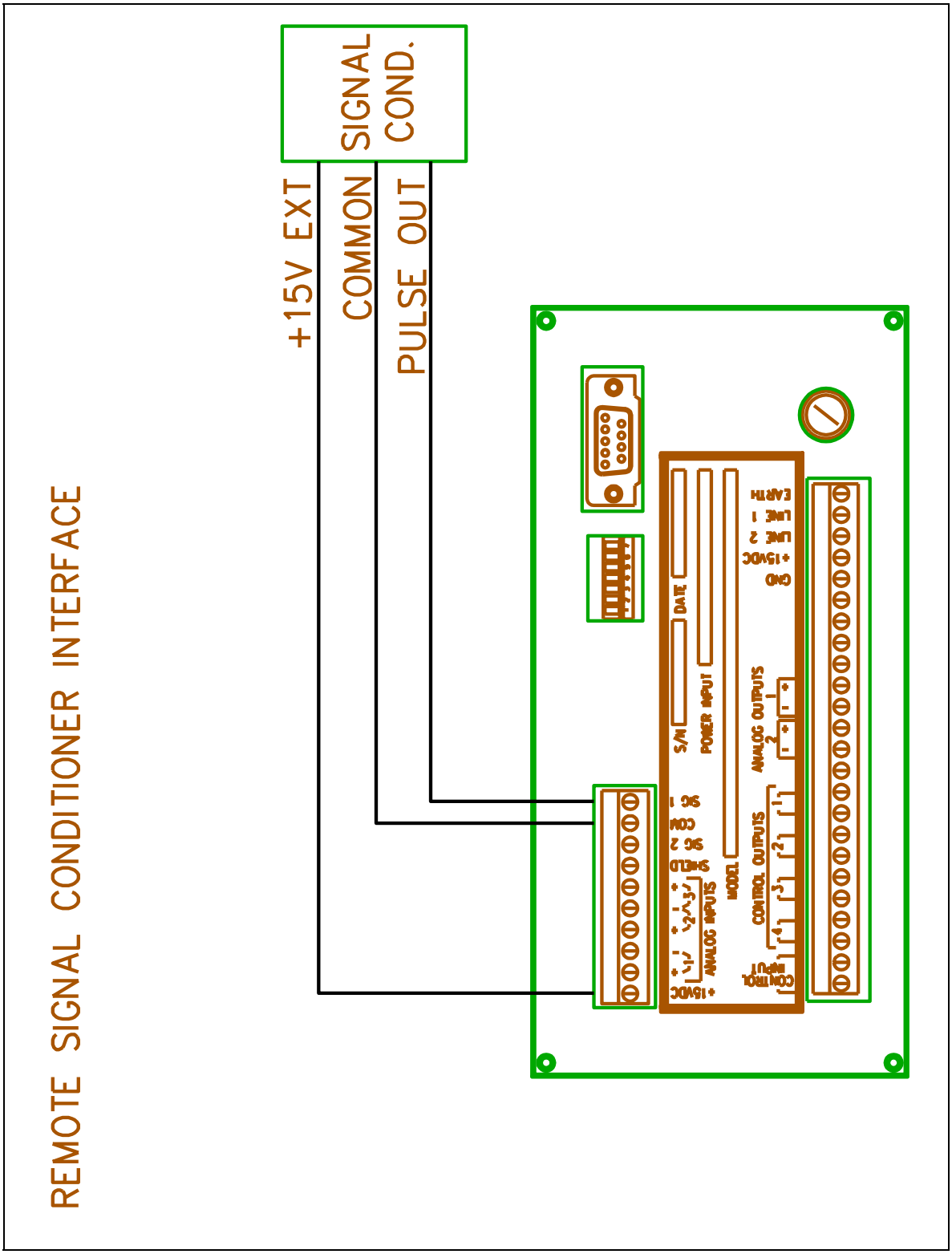


Figure 5.8 Analog Output Connections

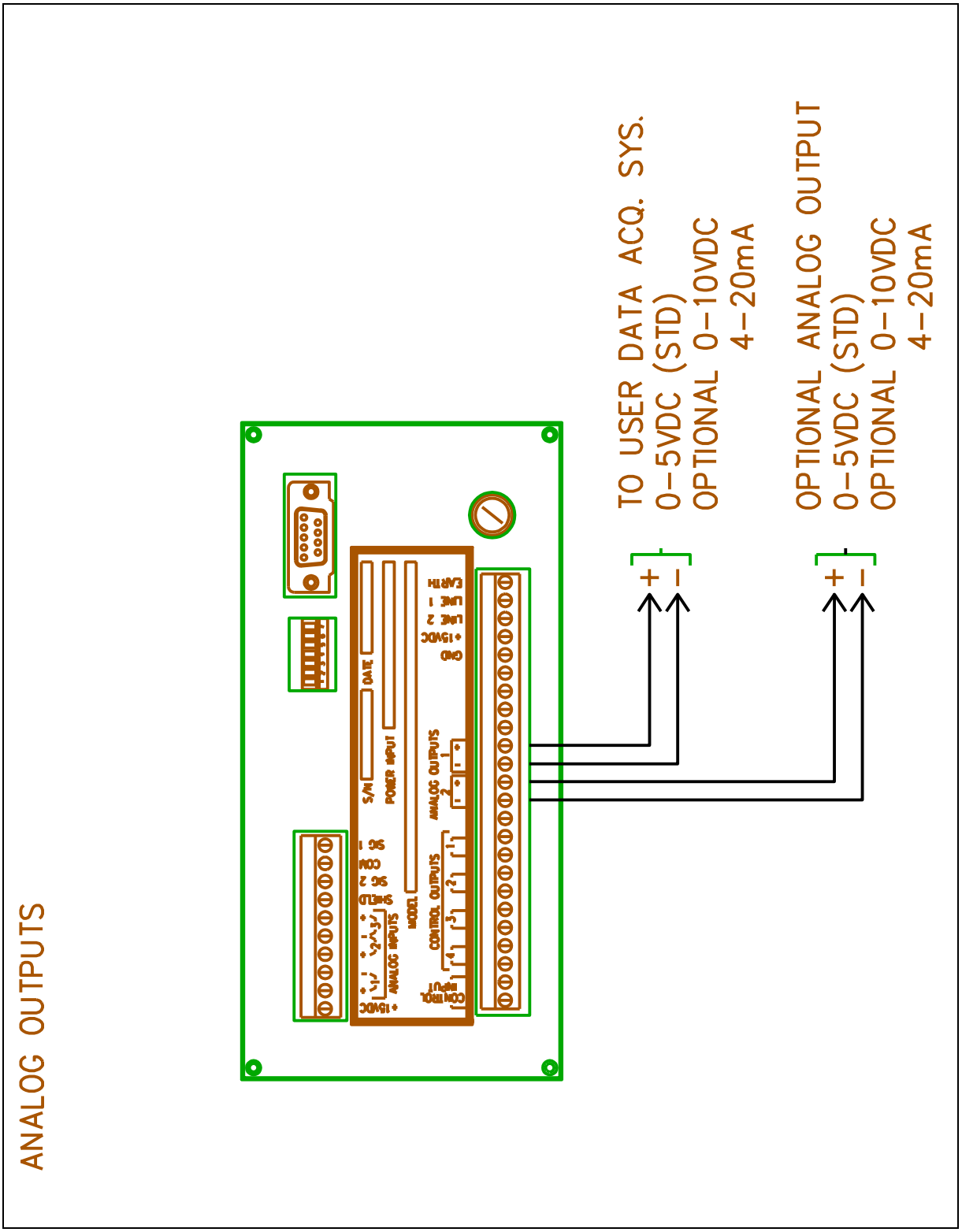


Figure 5.9 Two Wire process Transmitter Input Connections

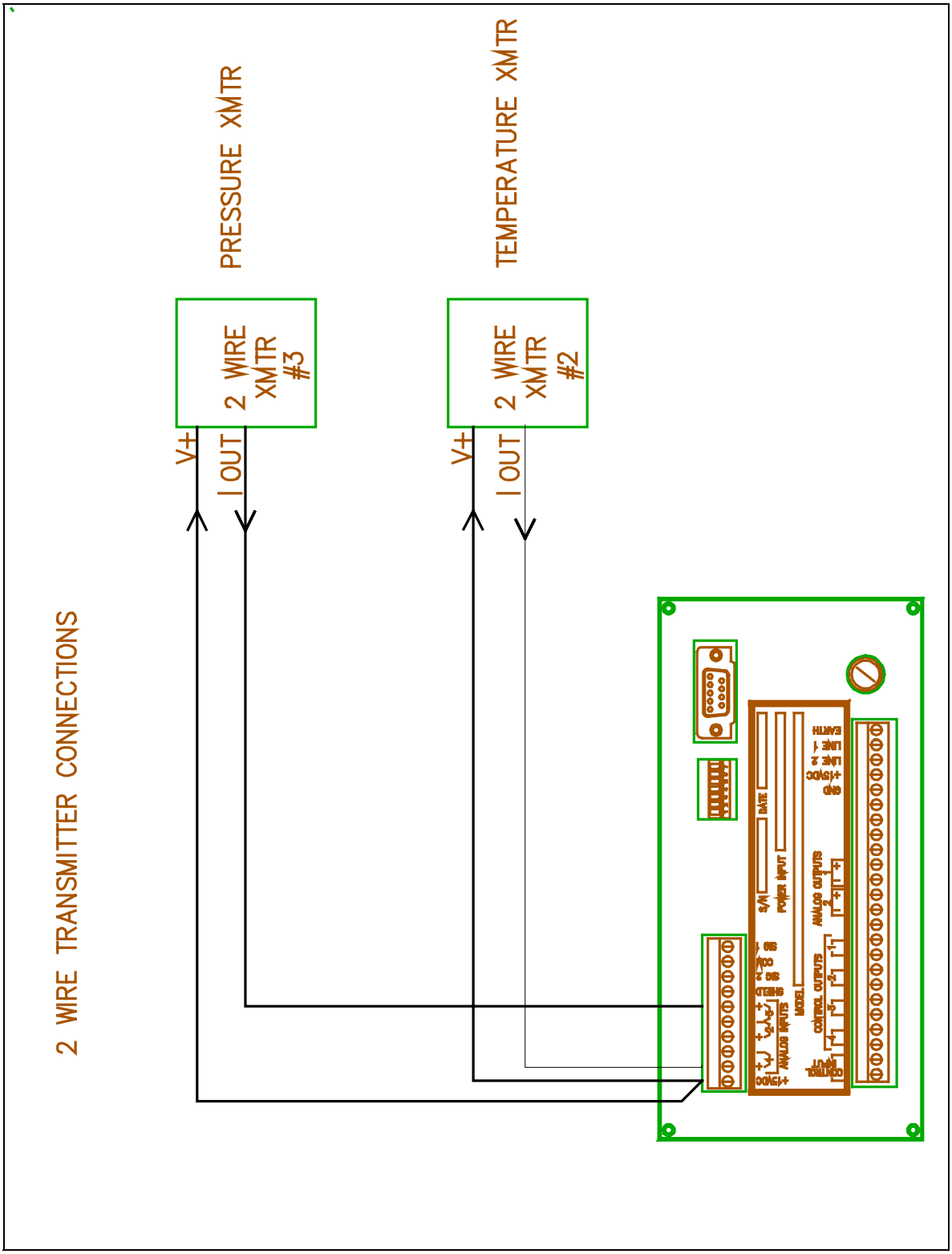


Figure 5.10 Three Wire Process Transmitter Input Connections

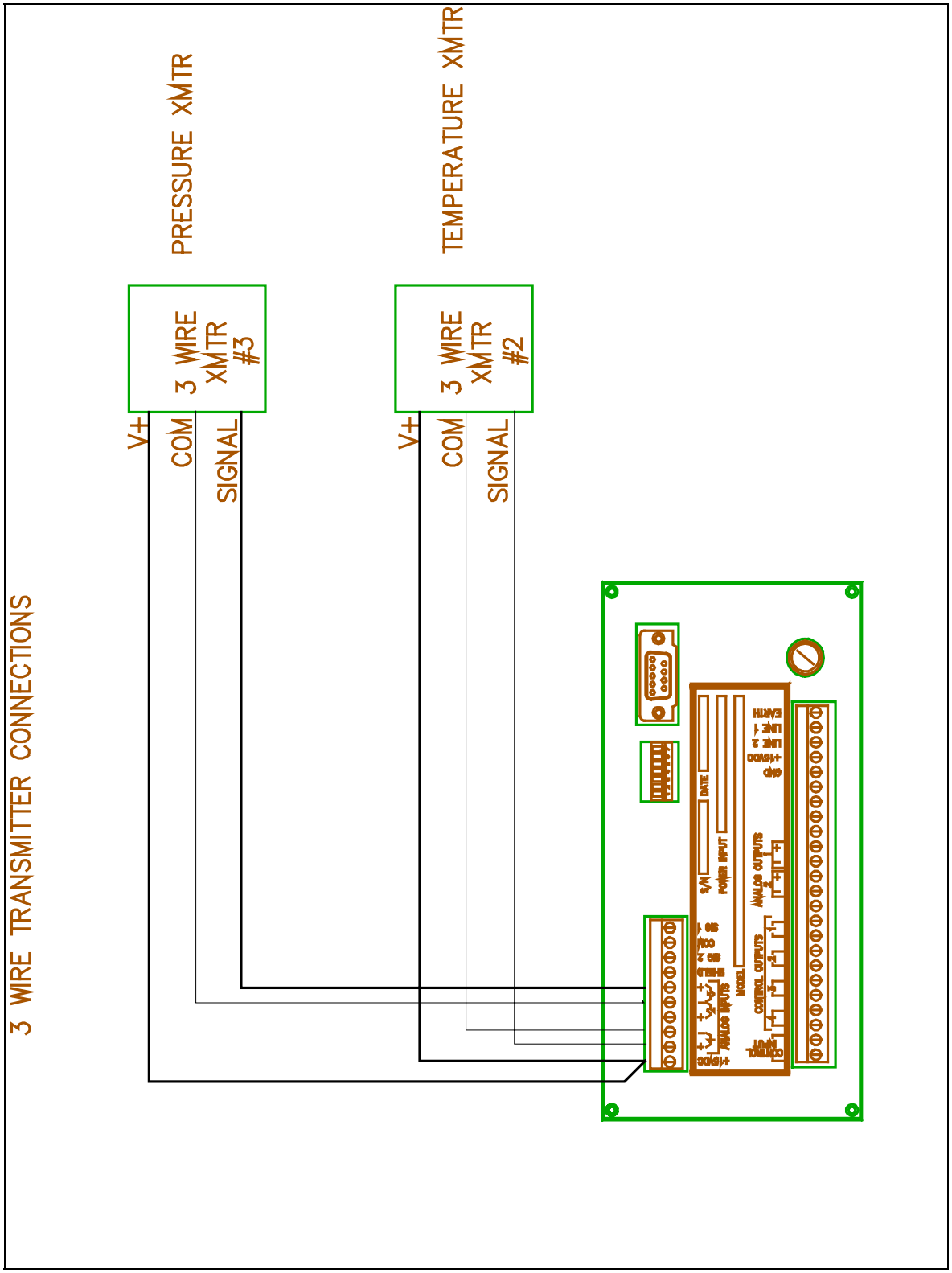


Figure 5.11 Pulse /Alarm Output Wiring

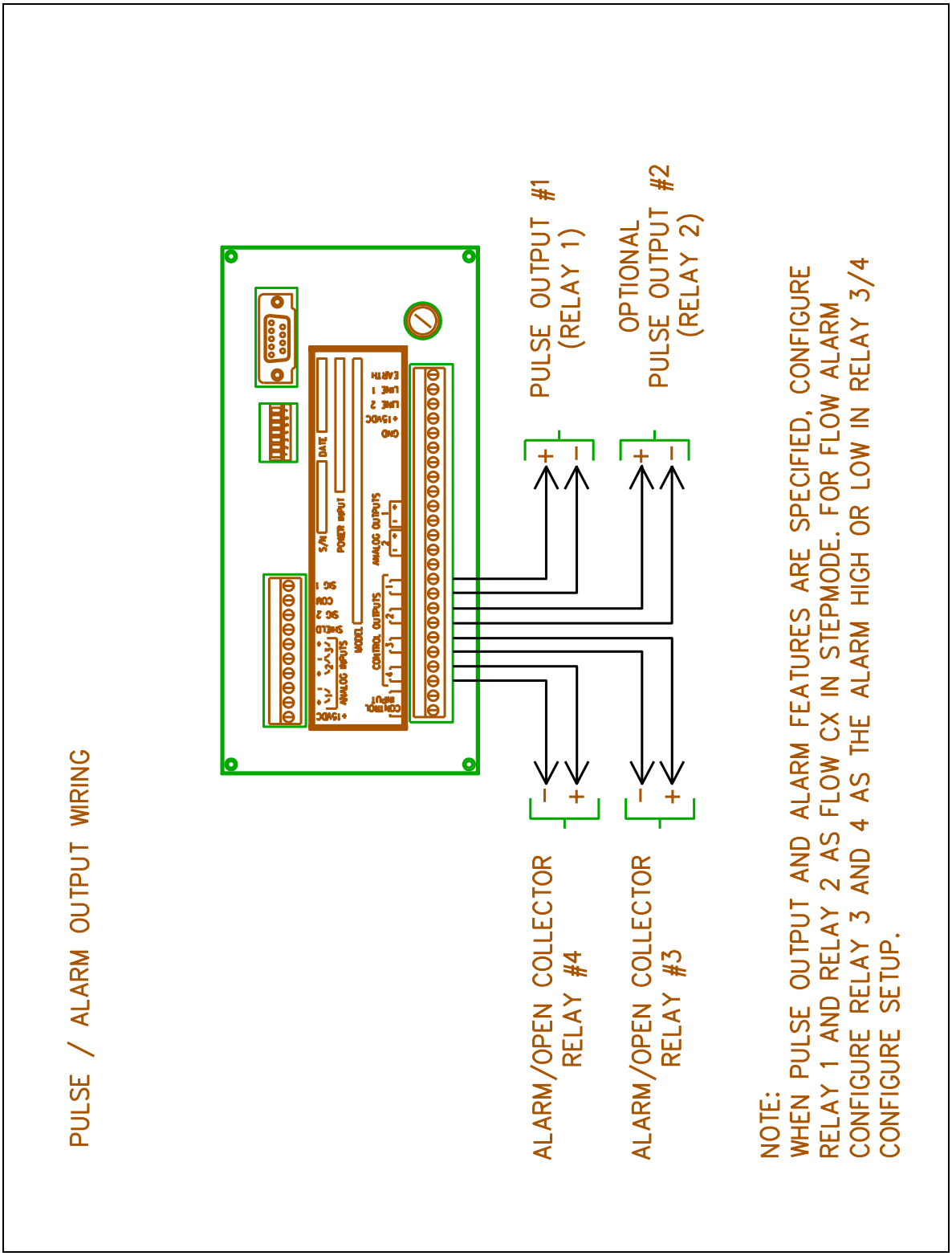
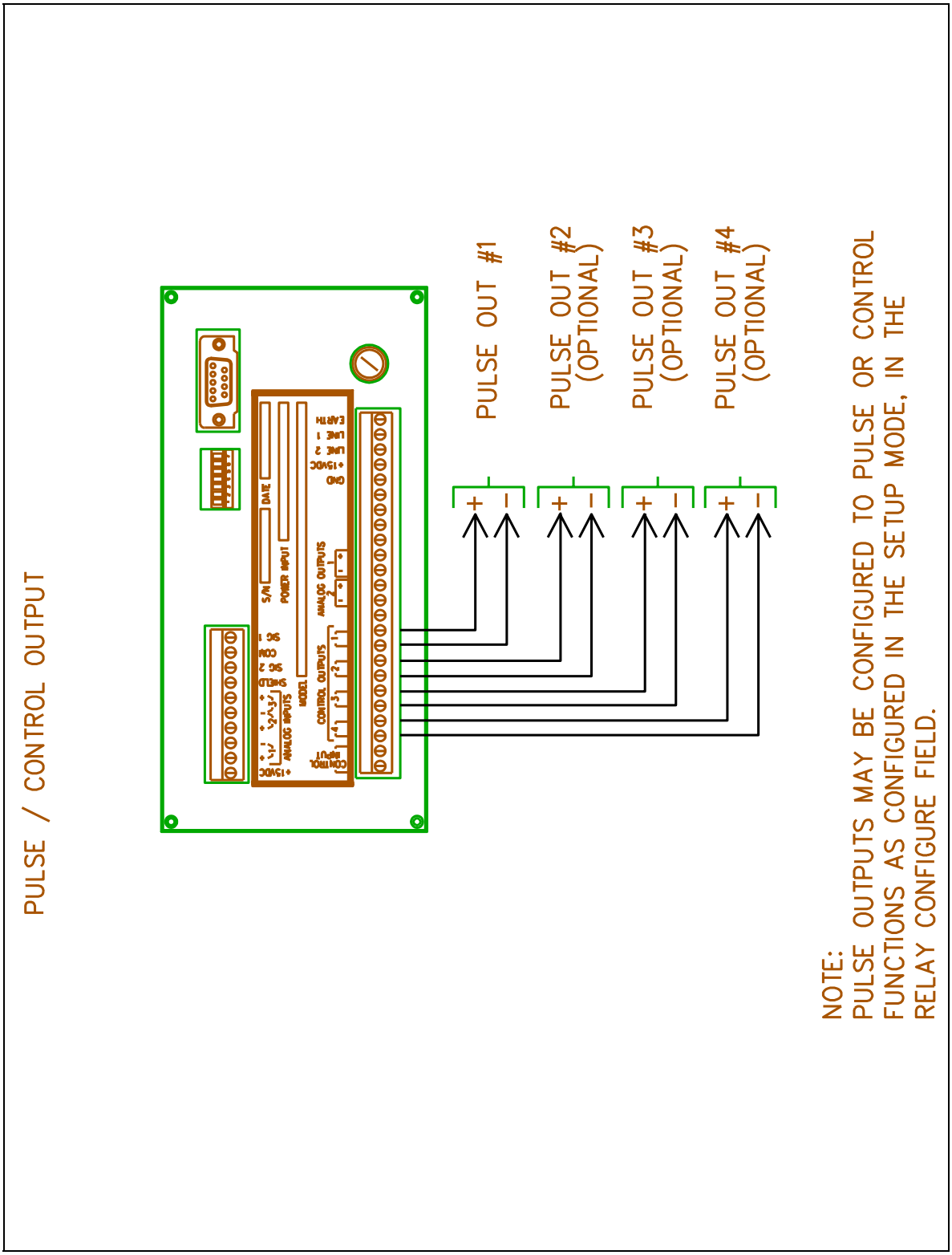


Figure 5.12 Pulse/Control Output Winring



6 SERIAL COMMUNICATIONS

6.1 INTRODUCTION

Flowstar's communication hardware port may configured as RS-232 or RS-422/RS-485(half duplex). The RS-232 port protocols may be configured as REMOTE KEYBOARD, HFC-5 INTERFACE, PRINTER 2010, or PRINTER. The RS-422/RS-485(half duplex) uses only the HFC-7 INTERFACE as the communication protocol. There are three communication protocols:

- REMOTE KEYBOARD this is a special configuration which allows Flowstar to be connected to a remote ANSI keyboard or personnel computer, via the RS-232;
- HFC-7 INTERFACE allows for the two way communication between a host system and Flowstar;
- PRINTER 2010 allows Hoffer supplied mini panel mount printer to be connected to the Flowstar 2005.
- PRINTER allows a standard serial printer to be connected to the RS-232 port of the Flowstar. A standard serial printer is a output printing device that supports RS-232C interface and ASCII(IBM) character code. The Flowstar can detect an OFF LINE printer if and only if the printer supports this feature through hardware hand-shaking.

The pin out wiring of the DB-9 connector on the back of the Flowstar is not standard. Please refer to drawing 500-0037(Flowstar Communication Cables) when making the connection between Flowstar and your computer

6.2 HFC-7 PROTOCOL

The Hoffer protocol allows for two way serial communications between the RS-232 or RS-422/RS-485 port to a host computer. The communication string consists of a start transmission code, unit ID number, a command code, specific data requested, data sent, end of transmission and checksum.

6.2.1 CONTROL COMMAND CALLER MESSAGE FORMAT

The following command format is used to perform remote operation of the Flowstar keypad. Execution of these commands will change the displayed information on the unit. The executed command will simply function as if the key were pressed on the actual unit. Flowstar will not respond back to the host with the new displayed data until a read data transmission is generated.

STX | nn | CT | sss | ETX | CKS

STX = 0x02
nn - unit id, 00 - 31
CT - control command
sss - keyboard input key number, ie., { 000 }
ETX - 0x03
CKS = exclusive or of each byte of data between the STX and ETX

Upon completion of the requested command, Flowstar will return an error code for the control command using the following:

STX | ee | ETX | CKS

STX = 0x02
ee - error codes:
00=no errors
01=invalid command
02=data out of range
03=access denied

Access is denied under the following conditions:

- A "FLOW" condition exist.
- Unit is in the SETUP mode.

ETX = 0x03
CKS - exclusive or of each byte of data between the STX and ETX

6.2.2 READ DATA COMMAND CALLER MESSAGE FORMAT

This group of commands allows the host computer system to read process conditions, and unit calibration data. To access data from Flowstar the read request must use the following command format.

STX | nn | RD | sss | ETX | CKS

STX = 0x02
nn - unit id, 00 - 31 for RS485. This value will be 00 for RS232.
RD - Read command.
sss - 3 characters specifying the specific field (000 - 421), as outlined in the Field Format Table.
ETX = 0x03
CKS - exclusive or of each byte of data between the STX and ETX

After receiving a read command from the host, Flowstar will respond with the read response command. This response will be in the following format:

STX | ee | ddd | ETX | CKS

STX = 0x02
ee - error codes:
- 00=no errors
- 01=invalid command
- 02=data out of range

ddd - Value=char; response 3 digit numeric from Field Format Table column DDD.
Value = flt; response may consist of 16 numeric characters with decimal point. Leading zeros are not required. ie. 123456.789.
Value = int; response may consist of 16 numeric characters. Leading zeros are not required. ie. 123456789.
ETX = 0x03
CKS - exclusive or of each byte of data between the STX and ETX

6.2.3 FLOWSTAR ID and S1 SWITCH STATUS

The ID and S1 switch tatus will be return when "999" is sent as the data read access value "sss". The following data format string describes the return message.

STK|ee|iiii|c|ETX|CKS

STK = 0x02:
ee - error values
- 00= no errors

iiii = 0500(indicates Flowstar 2005)
c - character representing the current S1 switch status.
BIT 0 = 0
BIT 1 = S1-7 Units, 1 = English, 0 = Metric.
BIT 2 = S1-6 Analog Output 2,
BIT 3 = S1-5 Analog Output 1
BIT 4 = S1-4 Pressure Input
BIT 5 = S1-3 Temperature Input
BIT 6 = S1-2 Local Control
BIT 7 = .S1-1 Program Enable
ETX = 0x03
CKS - Exclusive or of each byte of data between the STX and ETX charactors.

6.2.4 WRITE DATA COMMAND CALLER MESSAGE FORMAT

This command format allows the host computer system to write directly to the internal microprocessor registers of Flowstar. To write data to Flowstar the read request must use the following command format.

STX | nn | WR | sss | ddd | ETX | CKS

STX = 0x02
nn - unit id, 00 - 31
WR - Write command
sss - specific data, 3 characters specifying the specific field (000 - 421)
ddd - Value=char; response 3 digit numeric from Field Format Table column.
Value = flt; response may consist of 16 numeric characters with decimal point. Leading zeros are not required. ie. 123456.789.
Value =int; response may consist of 16 numeric characters. Leading zeros are not required. ie. 123456789.
ETX = 0x03
CKS - exclusive or of each byte of data between the STX and ETX

After receiving a write command from the host Flowstar will respond with the read response command. This response will be in the following format:

STX | ee | ETX | CKS

STX = 0x02
ee - error codes:
00 = no errors
01 = invalid command
02 = data out of range
ETX = 0x03
CKS - exclusive or of each byte of data between the STX and ETX

DATA FORMAT DESCRIPTIONS

Data may be transmitted to Flowstar using data formatted as either a character(char), floating(flt) numeric or an integer(int) numeric value.

Refer to the FIELD DATA TABLE for specific field formats.

For all char fields, 3 digit numeric entries are required corresponding to the specific field as listed in the FIELD DATA TABLE.

Floating fields may consist of up to 16 numeric characters with a decimal point. ie., {293.034}. Leading zeroes are not required here.

Integer values may also consist of up to 16 characters. Leading zeroes are not required here.

All characters between the STX and ETX must be ASCII alpha/numeric characters. In addition all alphabetic characters must be in upper case.

6.2.5 CHECKSUM DETERMINATION

The following routine used in the serial protocol calculates a checksum of all data bytes between the STX and ETX character. It takes as input a pointer to a string and the length of the string to calculate the checksum on. Its output is an unsigned character containing the checksum. The checksum itself is an exclusive or of all the bytes of data.

From Boolean algebra:

EXCLUSIVE OR = EOR = xy' + x'y

(chksum & ~*in_buff_ptr) | (~chksum & *in_buff_ptr)

Notice the similarity in the code to perform the EXCLUSIVE OR function. The rest of the code in the routine will perform the EOR the correct number of times on the input data string.

The format (ASCII, EBCDII, GRAY CODE, or what ever) of the bytes forming the string is completely irrelevant.

The following is a sample C program which may be used for the determination of the correct checksum.

```
unsigned char check_sum( unsigned char *in_buff_ptr, unsigned int abslen )
{
unsigned short int i;
unsigned char chksum;

  chksum = *in_buff_ptr++;
  for (i = 1; i < abslen; in_buff_ptr++, i++)
 chksum = (chksum & ~*in_buff_ptr) | (~chksum & *in_buff_ptr);
return( chksum );
}
```

6.3 TABLES

The following table indicated the equivalent code values for the specific keypad keys.

Table 2 Equivalent Key Commands

SSS	KEY EQUIVALENT
000	STOP
001	START
002	TOTAL
003	HEAT
004	CLEAR
005	MODE
006	RATE
007	SETP1
008	MAN
009	LAST
010	TEMP1
011	SETP2
012	AUTO
013	NEXT
014	TEMP2
015	AUX1
016	REM
017	SEL
018	PRES
019	AUX2

The following table is the Field Data Table. This information will be used to read all displayed data.

Table 3 Process Data Command

COMMAND	nnn	DESCRIPTION	VALUES
RD	000	CHANNEL 1 TOTAL	flt
RD	001	CHANNEL 1 RATE	flt
RD	002	CHANNEL 2 TEMPERATURE	flt
RD	003	FLOWING DENSITY	flt
RD	004	CHANNEL 3 PRESSURE	flt
RD	007	AUX 1 (RATE or TOTAL)	flt
RD	008	AUX 2 (RATE or TOTAL)	flt
RD	011	CHANNEL 1 ACCUMULATED TOTAL	flt
RD	013	VISCOSITY	flt
RD	015	AUDIT TRAIL CALIBRATION	int
RD	016	AUDIT TRAIL CONFIGURATION	int
RD	017 999	FLOWSTAR ID and S1 STATUS (See Section 6.6)	char

The following table is the Field Data Table.
This information will be used to read and write to the internal registers of Flowstar.

Table 4 Setup Command Data

COMMAND	SSS	SPECIFIC FIELD	VALUES	FIELD SELECTION	DDD
RD/WR	019	FLUID TYPE	char	GENERIC LIN LOX LAR LH2	000 001 002 003 004
RD/WR	020	COMP METHOD	char	MANUAL TEMPERATURE TEMP & PRESS	186 187 188
RD/WR	021	GAL INHIBIT	char	OFF OM	142 143
RD/WR	022	INTELIGENT BATCH	char	OFF OM	142 143
RD/WR	023	CONTINUE BATCH	char	OFF OM	142 143
RD/WR	024	PREWARN SETPNT	flt	Unit is in CH1 Total Units	
RD/WR	025	CONTROL SETPNT	flt	Unit is in CH1 Total Units	
RD/WR	026	CONTROL DELAY MS	int	0 - 999	
RD/WR	027	CH1 TOTAL SEE TABLE 6 FOR DEFINITION.	char	UNIT 1 UNIT 2 UNIT 3 UNIT 4 UNIT 5 UNIT 6 UNIT 7 UNIT 8 UNIT 9	010 011 012 013 014 015 016 017 018

COMMAND	SSS	SPECIFIC FIELD	VALUES	FIELD SELECTION	DDD
RD/WR	028	CH1 RATE SEE TABLE 6 FOR DEFINITION.	char	UNIT 1/MIN UNIT 1/HR UNIT 1/SEC UNIT 2/MIN UNIT 2/HR UNIT 2/SEC UNIT 3/MIN UNIT 3/HR UNIT 3/SEC UNIT 4/MIN UNIT 4/HR UNIT 4/SEC UNIT 5/MIN UNIT 5/HR UNIT 5/SEC UNIT 6/MIN UNIT 6/HR UNIT 6/SEC UNIT 7/MIN UNIT 7/HR UNIT 7/SEC UNIT 8/MIN UNIT 8/HR UNIT 8/SEC UNIT 9/MIN UNIT 9/HR UNIT 9/SEC	019 020 021 022 023 024 025 026 027 028 029 030 031 032 033 034 035 036 037 038 039 040 041 042 043 044 045
RD/WR	029	TEMP UNITS		DEG F DEG R DEG C DEG K	106 107 108 109
RD/WR	030	PRESSURE UNITS		PSIG PSIA ATM BAR A BAR G KPAS A KPAS G	099 100 101 102 103 104 105
RD/WR	031	CH1 DATA ATIME	flt	0.0 - 10.0	
RD/WR	032	CH1 POINT	int	00 - 20	

COMMAND	SSS	SPECIFIC FIELD	VALUES	FIELD SELECTION	DDD
		NUMBER			
RD/WR	033	C1 PULSE WEIGHT	flt		
RD/WR	034	FLOW CALC METHOD	char	SINGLE KFACTOR KFACTOR TEMP vsVISCOSITY FWD REV KFACTOR F/R TEMP vsVISCOSITY	094 095 096 097 098
RD/WR	035	DEF TEMP	flt	In selected temperature unit.	
RD/WR	036	DEF PRES	flt	In selected pressure unit.	
RD/WR	037	DEF DENS (CH1)	flt	Unit is LBS/GAL or KG/LIT dependent on the setting of S1-1.	
RD/WR	038	BASE DENS (CH1)	flt	Unit is LBS/GAL or KG/LIT dependent on the setting of S1-1.	
RD/WR	039	DEF KFACTOR	flt	Unit is P/GAL or P/LIT dependent on the setting of S1-1.	
RD/WR	040	USER DEFINE (CH1)	flt	Unit is USER GAL TO UDEF or USER LIT TO UDEF dependent on the setting of S1-1.	
RD/WR	041 thru 060	FWD FREQ 1 thru FWD FREQ 20	flt	Unit is Hz(cycles per second).	
RD/WR	061 thru 080	FWD KFAC 1 thru FWD KFAC 20	flt	Unit is P/GAL or P/LIT depending on the setting of S1-1.	
RD/WR	081 thru 100	REV FREQ 1	flt	Unit is Hz(cycles per	

COMMAND	SSS	SPECIFIC FIELD	VALUES	FIELD SELECTION	DDD
		thru REV FREQ 20		second).	
RD/WR	101 thru 120	REV KFAC 1 thru REV KFAC 20	flt	Unit is P/GAL or P/LIT depending on the setting of S1-1.	
RD/WR	121 thru 140	FWD HZ/CSTK 1 thru FWD HZ/CSTK 20	flt	Unit is Hz/CSTK(Used on Viscosity calculations).	
RD/WR	141 thru 160	FWD KFAC 1 thru FWD KFAC 20	flt	Unit is P/GAL or P/LIT depending on the setting of S1-1. Used on Viscosity calculations	
RD/WR	161 thru 180	REV HZ/CSTK 1 thru REV HZ/CSTK 20	flt	Unit is Hz/CSTK(Used on Viscosity calculations).	
RD/WR	181 thru 200	REV KFAC 1 thru REV KFAC 20	flt	Unit is P/GAL or P/LIT depending on the setting of S1-1. Used on Viscosity calculations.	
RD/WR	201	ATD DATA ATIME	flt	0.0 - 10.0	
RD/WR	202	CH2 POINT NUMBER	int	2 - 5	
RD/WR	205 thru 209	CH2 MP UNIT 1 thru 5	flt	In selected temperature unit.	
RD/WR	210	CH3 POINT NUMBER	int	2 - 5	
RD/WR	213 thru 217	CH3 MP UNIT 1 thru 5	flt	In selected pressure unit.	
RD/WR	218	FLUID TABLE PT	int	02 - 20	

COMMAND	SSS	SPECIFIC FIELD	VALUES	FIELD SELECTION	DDD
RD/WR	219	FLUID MAX PRES	flt	In selected pressure unit.	
RD/WR	220 thru 239	TEMP UNIT 1 thru 20	flt	In selected temperature unit.	
RD/WR	240 thru 259	PSAT UNIT 1 thru 20	flt	In selected pressure unit.	
RD/WR	260 thru 279	DSAT UNIT 1 thru 20	flt	Unit is LBS/GAL or KG/LIT depending on the setting of S1-1.	
RD/WR	280 thru 299	DCP UNIT 1 thru 20	flt	Unit is LBS/GAL or KG/LIT depending on the setting of S1-1	
RD/WR	300 thru 319	VISCOSITY 1 thru 20	flt		

COMMAND	SSS	SPECIFIC FIELD	VALUES	FIELD SELECTION	DDD
RD/WR	320	AUX1 UNITS	char	UNIT 1	010
				UNIT 2	011
	321	AUX2 UNITS		UNIT 3	012
				UNIT 4	013
				UNIT 5	014
				UNIT 6	015
		SEE TABLE 6 FOR DEFINITION		UNIT 7	016
				UNIT 8	017
				UNIT 9	018
				UNIT 1/MIN	019
				UNIT 1/HR	020
				UNIT 1/SEC	021
				UNIT 2/MIN	022
				UNIT 2/HR	023
				UNIT 2/SEC	024
				UNIT 3/MIN	025
				UNIT 3/HR	026
				UNIT 3/SEC	027
				UNIT 4/MIN	028
				UNIT 4/HR	029
				UNIT 4/SEC	030
				UNIT 5/MIN	031
				UNIT 5/HR	032
				UNIT 5/SEC	033
				UNIT 6/MIN	034
				UNIT 6/HR	035
				UNIT 6/SEC	036
				UNIT 7/MIN	037
				UNIT 7/HR	038
				UNIT 7/SEC	039
				UNIT 8/MIN	040
				UNIT 8/HR	041
				UNIT 8/SEC	042
				UNIT 9/MIN	043
				UNIT 9/HR	044
				UNIT 9/SEC	045
				CONVERSION TOTAL UNIT 1	046
				CONVERSION TOTAL UNIT 2	047
				CONVERSION TOTAL UNIT 3	048
				CONVERSION RATE UNIT 1	049
				CONVERSION RATE UNIT 2	050
				CONVERSION RATE UNIT 3	051

COMMAND	SSS	SPECIFIC FIELD	VALUES	FIELD SELECTION	DDD
RD/WR	322	ALM1 S-H Rate Unit	flt	In selected CH1 Rate Unit.	
RD/WR	323	ALM1 S- L Rate Unit	flt	In selected CH1 Rate Unit.	
RD/WR	324	ALM1 DBA Rate Unit	flt	In selected CH1 Rate Unit.	
RD/WR	325	ALARM1 AUDIBLE	char	OFF HIGH ONLY LOW ONLY HIGH AND LOW	144 145 146 147
RD/WR	326	ALM2 S-HI Temp Unit	flt	In selected Temperature Unit.	
RD/WR	327	ALM2 S-LO Temp Unit	flt	In selected Temperature Unit.	
RD/WR	328	ALM2 DBAN Temp Unit	flt	In selected Temperature Unit.	
RD/WR	329	ALARM2 AUDIBLE	char	OFF HIGH ONLY LOW ONLY HIGH AND LOW	144 145 146 147
RD/WR	330	ALM3 S-HI Pres. Unit	flt	In selected Pressure Unit.	
RD/WR	331	ALM3 S-L0 Pres. Unit	flt	In selected Pressure Unit.	
RD/WR	332	ALM3 DBAN Pres. Unit	flt	In selected Pressure Unit.	
RD/WR	333	ALARM3 AUDIBLE	char	OFF HIGH ONLY LOW ONLY HIGH AND LOW	144 145 146 147

COMMAND	SSS	SPECIFIC FIELD	VALUES	FIELD SELECTION	DDD
RD/WR	334 337	DA1 CONFIG DA2 CONFIG	char	MIMIC C1 RATE MIMIC C2 TEMP. MIMIC C3 PRES. MIMIC C1 FWD/REV	127 128 129 130
RD/WR	335	DA1 MIN Unit	flt	In MIMIC channel's Unit.	
RD/WR	336	DA1 MAX Unit	flt	In MIMIC channel's Unit.	
RD/WR	338	DA2 MIN Unit	flt	In MIMIC channel's Unit.	
RD/WR	339	DA2 MAX Unit	flt	In MIMIC channel's Unit.	
RD/WR	340 341	RELAY1 CONFIG RELAY2 CONFIG	char FS2005 FS2007	ALARM1 HIGH ALARM1 LOW ALARM2 HIGH ALARM2 LOW ALARM3 HIGH ALARM3 LOW ALARM AUDIBLE PUMP INTERLOCK CH1 FWD SCALED PULSE CH1 REV SCALED PULSE PREWARN CONTROL	131 132 133 134 135 136 137 138 139 140 140 141
RD/WR	342 343	RELAY3 CONFIG RELAY4 CONFIG	char FS2007	ALARM1 HIGH ALARM1 LOW ALARM2 HIGH ALARM2 LOW ALARM3 HIGH ALARM3 LOW ALARM AUDIBLE PUMP INTERLOCK PREWARN CONTROL	132 133 134 135 136 137 138 139 141 142

COMMAND	SSS	SPECIFIC FIELD	VALUES	FIELD SELECTION	DDD
RD/WR	344	SERIAL MODE	char	RS232 RS422 RS485	167 168 169
RD/WR	345	SERIAL MODE NUM	int	00 - 31	
RD/WR	346	SERIAL BAUD RATE	char	9600 4800 2400 1200 600 300 150 75	170 171 172 173 174 175 176 177
RD/WR	347	SERIAL HAND-SHAKE	char	NONE HARDWARE DTR XON/XOFF	178 179 180
RD/WR	348	SERIAL PROTOCOL	char	REMOTE KEYBOARD HFC-7 INTERFACE PRINTER LC24X PRINTER	181 182 183 184
RD/WR	349	PASSWORD	int	0000-9999	
RD/WR	350	DATE	tim	mmddyy	
RD/WR	351	DAY OF WEEK	char	MON TUE WED THU FRI SAT SUN	148 149 150 151 152 153 154
RD/WR	352	TIME 24 HOUR CLK	tim	hhmmss	

Table 5 Unit Descriptions

Switch S1-1 Setting	**ENGLISH**	**METRIC**
UNIT 1	LBS	KG
UNIT 2	FT^3	M^3
UNIT 3	GAL	LIT
UNIT 4	OZ	GR
UNIT 5	FLOZ	CC
UNIT 6	PNTS	MLIT
UNIT 7	BBL	VOID
UNIT 8	TONS	MTON
UNIT 9	UDEF	UDEF
CONVERSION UNIT 1	KG	LBS
CONVERSION UNIT 2	M3	FT3
CONVERSION UNIT 3	LIT	GAL

6.4 PRINTER

In the PRINTER mode the Flowstar will generate Delivery Tickets when ever the REM/PRINT key is depressed. The attached device must be a RS-232C serial printer that supports the ASCII(IBM) character code table. The Flowstar detects printer status only when the printer supports this feature through hardware hand-shaking. To enable the printer support the following settings must be made at the Flowstar.

1. SERIAL MODE = RS232
2. BAUD RATE = baud rate of attached device.
3. HANDSHAKE = NONE
4. SERIAL PROTOCOL = PRINTER 2010 or PRINTER.

The pin connections of the DB-9 communications connection on the back of Flowstar are not standard. Please refer to 500-0037, *"FLOWSTAR COMMUNICATION CABLES"* when making your own cable to connect a printer to the FLOWSTAR. If you printer supports PAPER OUT detection, then contact Hoffer Flow Controls for information on the proper wiring of the Flowstar to your printer.

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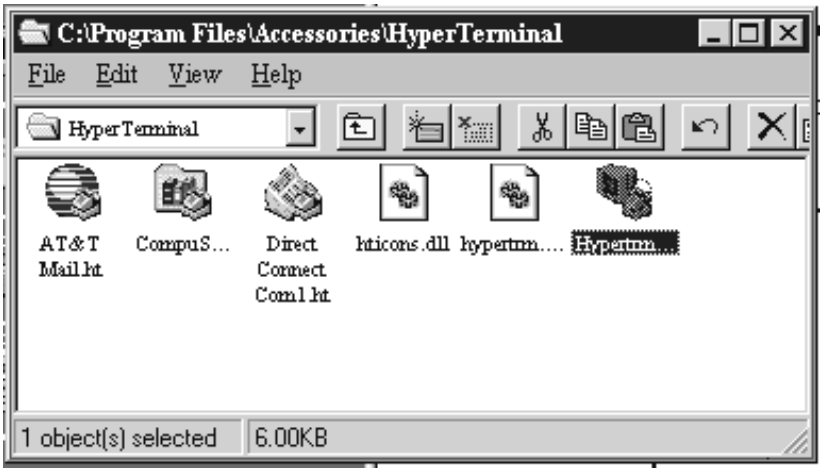
7 APPENDIX: COMMUNICATIONS OPTIONS

7.1 USING FLOWSTAR with ANSI TERMINAL

The Flowstar 2005 is configurable for use with an ANSI terminal. In this configuration FLOWSTAR may be connected to a ANSI terminal, via the RS-232 communication option when SERIAL PROTOCOL is configured for REMOTE TERMINAL Control is also possible by using a ANSI compatible communications software on a personal computer. HyperTerminal included with Windows 95, is ANSI compatible. Other examples of ANSI compatible communication software are ProCom, CrossTalk, Telix, and Windows 3.X Terminal. Listed below are the steps necessary to used HyperTerminal application with the Flowstar.

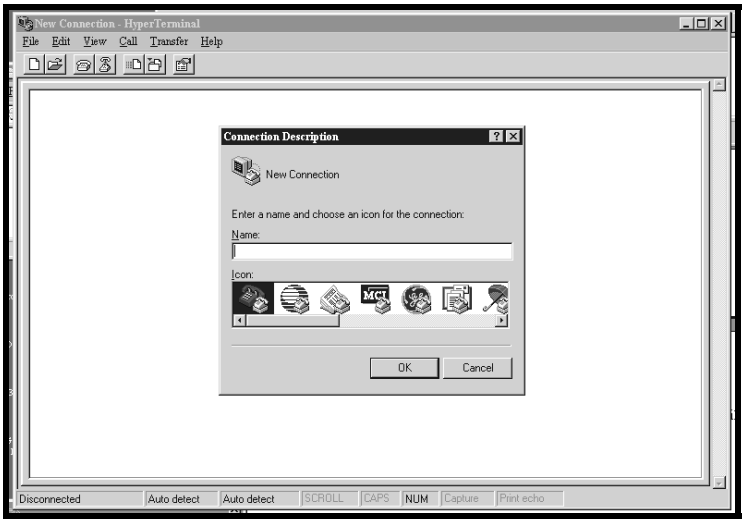
1. Using your mouse, point to the START button located on the Task Bar. Click on START, point to Accessories and drag the pointer of mouse down to the Hyper-Terminal Folder. Click on the HyperTerminal folder and it will appear on the screen.

Figure 7.1 Program Selection



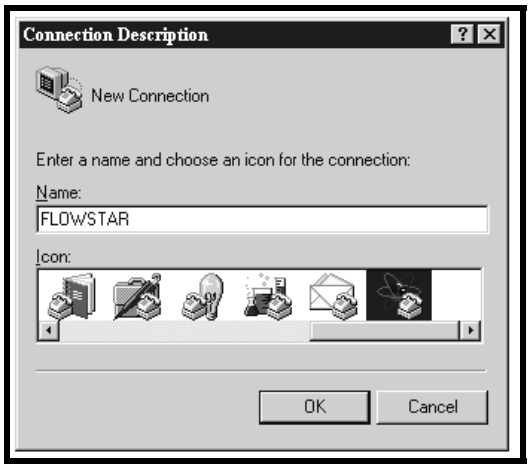
2. Double-click on the Hyper-Terminal icon, the Hyper Terminal program will start.

Figure 7.2 Icon Selection



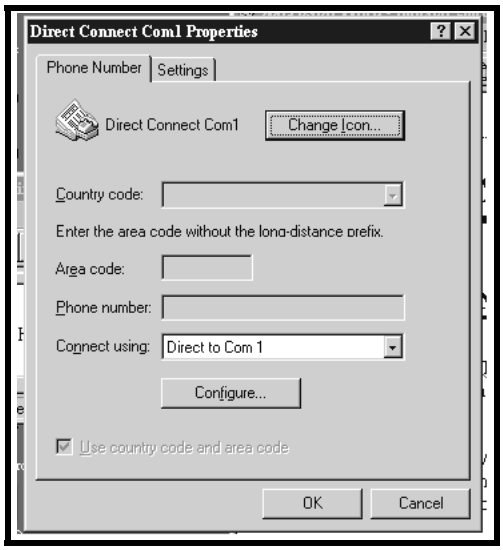
3. When the Hyper-Terminal program starts up, a new Connections Properties box will appear. Enter the name for the new connection and choose an icon. Click OK when finish. Example is shown below.

Figure 7.3 Command Line Description



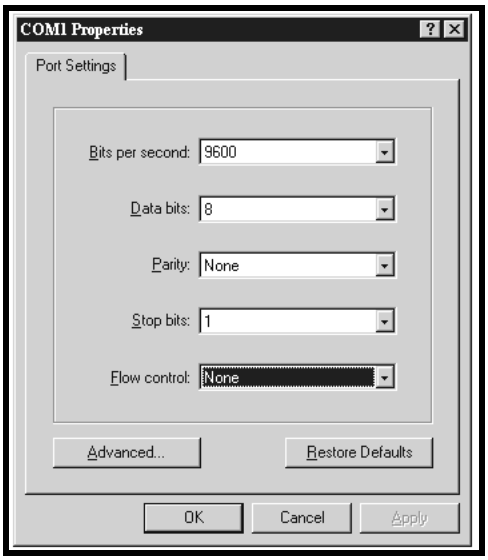
4. Select the port that will be connected to the Flowstar. Click OK when you are finished selecting the port.

Figure 7.4 Direct Connection Properties



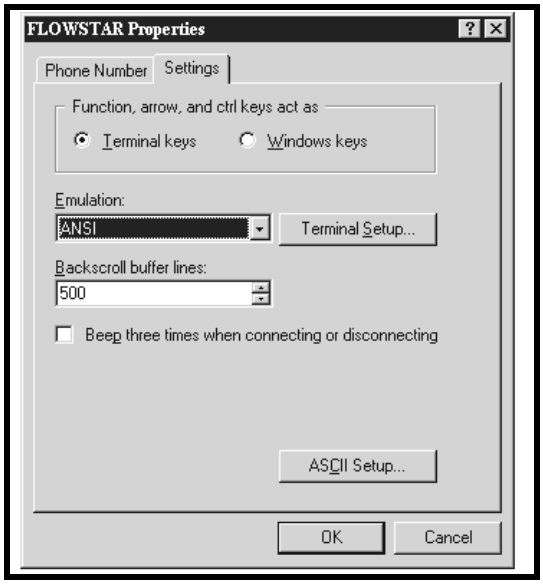
5. The Port Settings dialog box will appear next. Set the Bit Per Second speed to 9600. Set the Flow Control to None. Check the rest of the settings. Click OK when all settings are corrected.

Figure 7.5 COM Port Properties



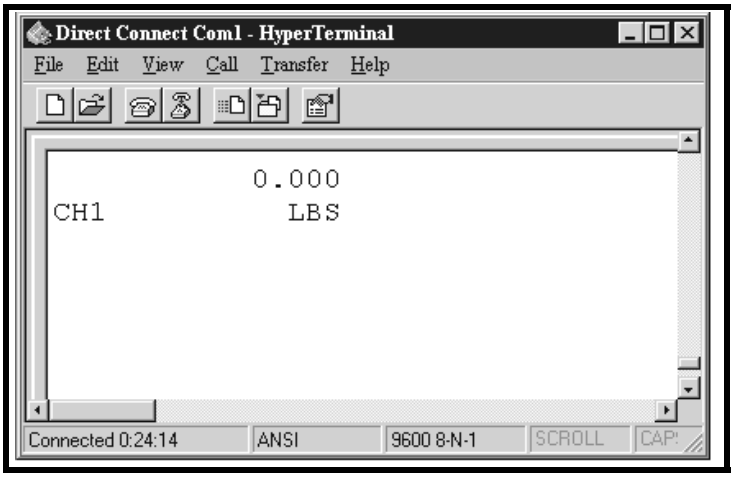
6. Next click on File and then on Properties. The Flowstar Properties dialog will appear. Click on the Settings tab and set Emulation to ANSI. Click OK after making the setting.

Figure 7.6 Connection Properties



7. You can adjust the size and position of the terminal window in Hyper-Terminal. It should look something like the example shown below when its properly working.

Figure 7.7 Program Display



7.1.1 ANSI TEMINAL KEY-MAPPING

ANSI terminals and emulation programs will accept commands from the keyboard and send then to the Flowstar. The following table shows the key-mapping used to control Flowstar from ANSI terminals and PC emulation programs.

Table 6 ANSI Key Mapping for Remote Terminal

Flowstar Keys	PC Keys
TOTAL / 1	1
RATE /2	2
TEMP 1 /3	3
TEMP 2 /4 (DENSITY)	4
PRES /5	5
HEAT /DUAL/ 6	6
SEP1 / 7	7
SEP2 / 8	8
AUX1 / 9	9
AUX2 / 0	0
START / .	.
STOP / SHIFT (+/-)	-
MODE	M,m
LAST / <	<
NEXT / >	>,ENTER
SEL	S,s,+
CLEAR	C,c
MAN	N,n
AUTO	A,a
REM/PRINT	R,r

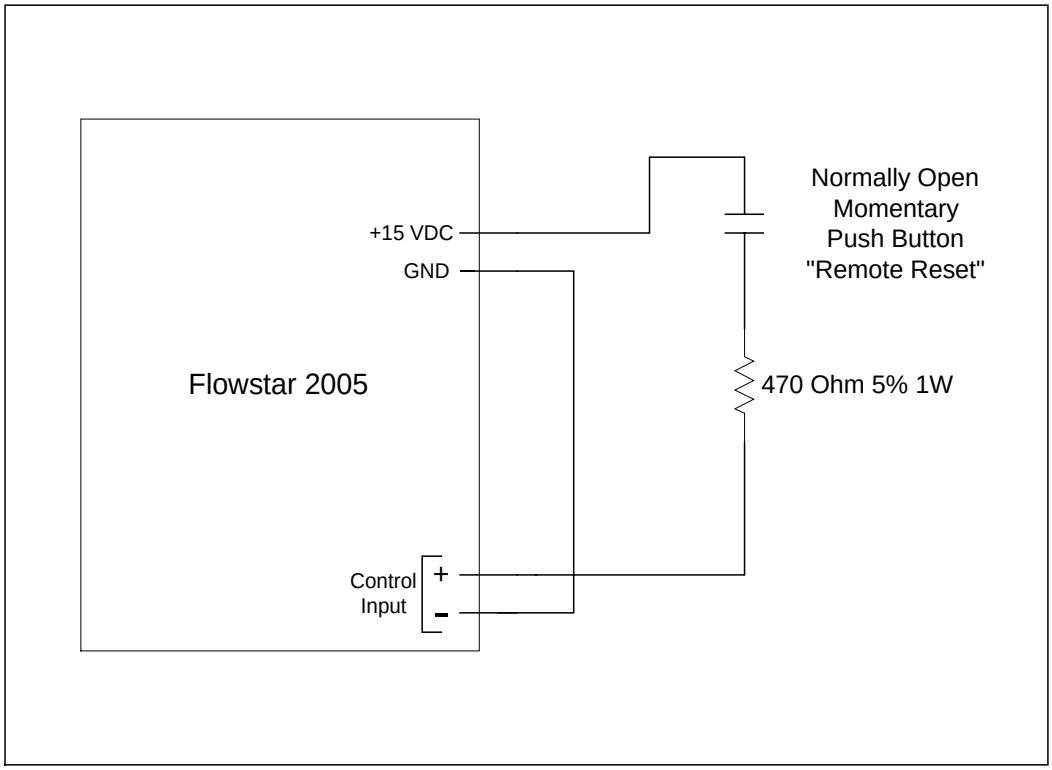
7.1.2 ANSI TERMINAL SCREEN REFRESH

If the display on you PC or ANSI terminal becomes garbled, press the small letter <k> to refresh the display.

8 APPENDIX: REMOTE RESET

8.1 Wiring Remote Reset Function

If using the Flowstar internal power supply, wire the Remote Reset per the drawing below.



WARNING If using an external power supply to supply voltage to the Remote Reset circuit, the power supply should have an output of 5 to 16 VDC.

8.2 Clearing the Flowstar 2005 using an REMOTE RESET

The Remote Reset functions in the same manner as the CLEAR key located on the Flowstar. Please refer to the OPERATING MODE section of this manual for information on using the CLEAR key. To clear the Flowstar while CH1 total is being displayed, press and release the Remote Reset button.

9 DRAWINGS: DRAWINGS

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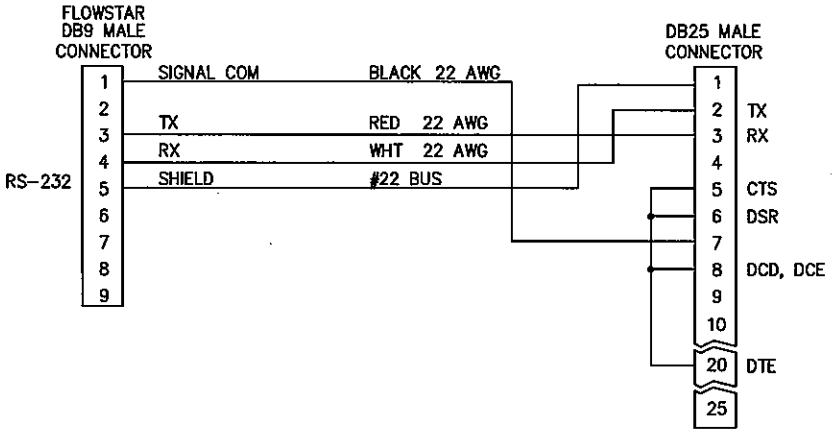
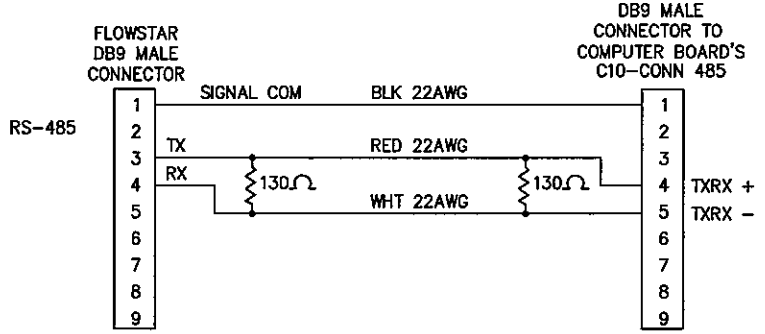
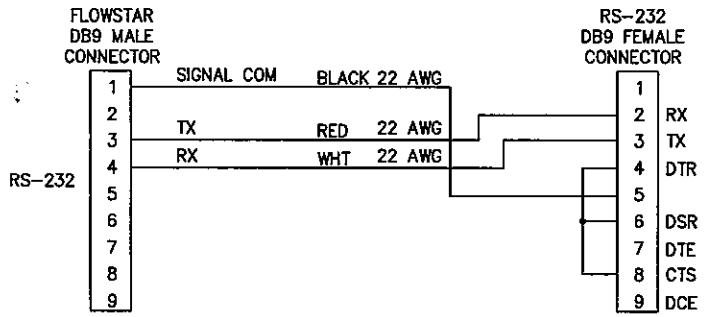
DWG NO.	500-0037	SH 1	REV B

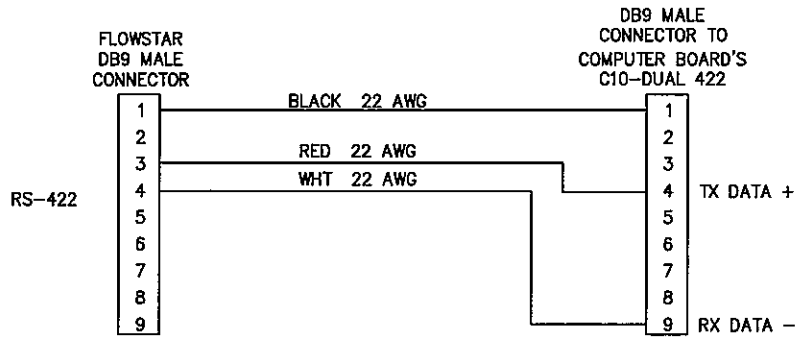
REVISIONS

ZONE	REV	DESCRIPTION	DATE	APP
	A	ZN B1, PIN 9 WAS PIN 5, ADDED TX DATA + AND RX DATA -. (CS)	941102	JD
	B	PER ECP 500-107, ZN 3D WAS FEMALE DB25 CONNECTOR	151201	V.K.









		MATERIAL	DRAWN SWEET		DATE 941018
			CHECK BRE		941024
			PRODUCTION		
		FINISH	PROJ ENG J.DEFEO		941024
			MACH SHOP		
NEXT ASSY	USED ON	CONFIDENTIAL PROPERTY OF HOFFER FLOW CONTROLS, INC. (HFC) NOT TO BE DISCLOSED TO OTHERS, REPRODUCED, OR USED FOR ANY OTHER PURPOSE, EXCEPT AS AUTHORIZED IN WRITING BY HFC. MUST BE RETURNED ON DEMAND, ON COMPLETION OF ORDER OR OTHER PURPOSE FOR WHICH LENT.	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES OTHER THAN THE SIZE OF RAW MATERIAL SHALL BE HELD AS FOLLOWS: 2 PLACE DECIMALS ± .01, 3 PLACE DECIMALS ± .005, FRACTIONAL ± 1/64, ANGULAR ± 1/2°		
APPLICATION					

HOFFER FLOW CONTROLS, INC
ELIZABETH CITY, NC 27909

TITLE
FLOWSTAR COMMUNICATIONS CABLES

SIZE	CAGE CODE	DWG NO	REV
C	33321	500-0037	B

SCALE NONE SHEET 1 OF 1

DWG NO.	TRANS-908	SH 1	REV C

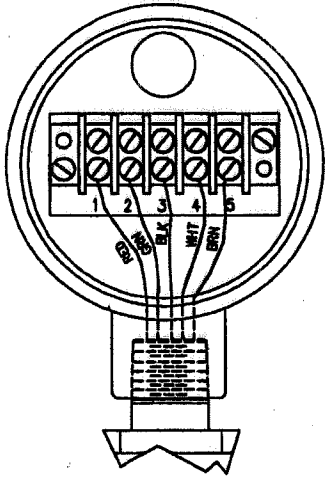
REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APP
	A	REMOVED MODEL 870. (CS)	941214	JD
	B	ADDED MODEL 770. (CS)	950912	JD
	C	REVISED PER ECP 454, CHANGED TB TO 3 POSITION FOR MODEL 570 DWG NO WAS 500-0041	000223	

ELECTRICAL CONNECTIONS:

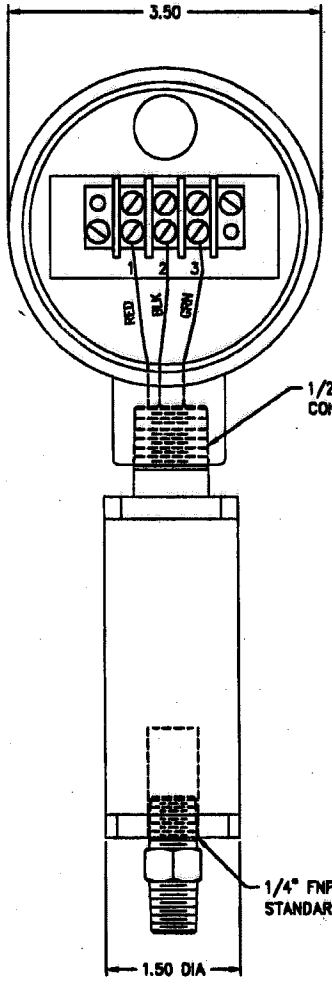
MODEL 570 1/2" MNPT. 3 WIRES 18AWG
- RED + POWER/SIGNAL
- BLACK - POWER/SIGNAL
- GREEN CASE GROUND

MODEL 770
- RED +INPUT
- GREEN -INPUT
- BLACK +OUTPUT
- WHITE -OUTPUT
- BROWN CASE GROUND

MODEL 770



MODEL 570



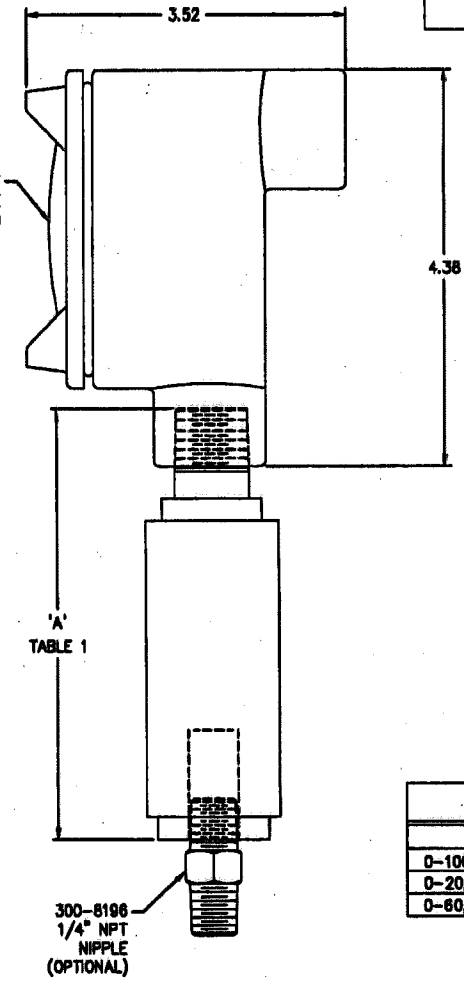


TABLE 1	DIM 'A'	
RANGE	MODEL 570	MODEL 770
0-100 THRU 0-15,000 PSIS	4.94	5.19
0-20,000 THRU 0-50,000 PSIS	5.06	5.32
0-60,000 THRU 0-100,000 PSIS	5.81	6.06

		MATERIAL	DRAWN SWEET	DATE 941102
			CHECK J.DEFEO	941102
			PRODUCTION	
		FINISH	PROJ ENG KRH	941102
			MACH SHOP	
NEXT ASSY	USED ON			
APPLICATION				

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UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES OTHER THAN THE SIZE OF RAW MATERIAL SHALL BE HELD AS FOLLOWS:

2 PLACE DECIMALS	± .01
3 PLACE DECIMALS	± .005
FRACTIONAL	± 1/64
ANGULAR	± 1/2°

HOFFER FLOW CONTROLS, INC
ELIZABETH CITY, NC 27909

TITLE
INSTALLATION DRAWING, MODEL 570 & 770 PRESSURE TRANSMITTER

SIZE	CAGE CODE	DWG NO	REV
C	33321	TRANS-908	C

SCALE NONE SHEET 1 OF 1

DWG NO.	TRANS-112	SH 1	REV

REVISIONS

ZONE	REV	DESCRIPTION	DATE	APP

NOTES:

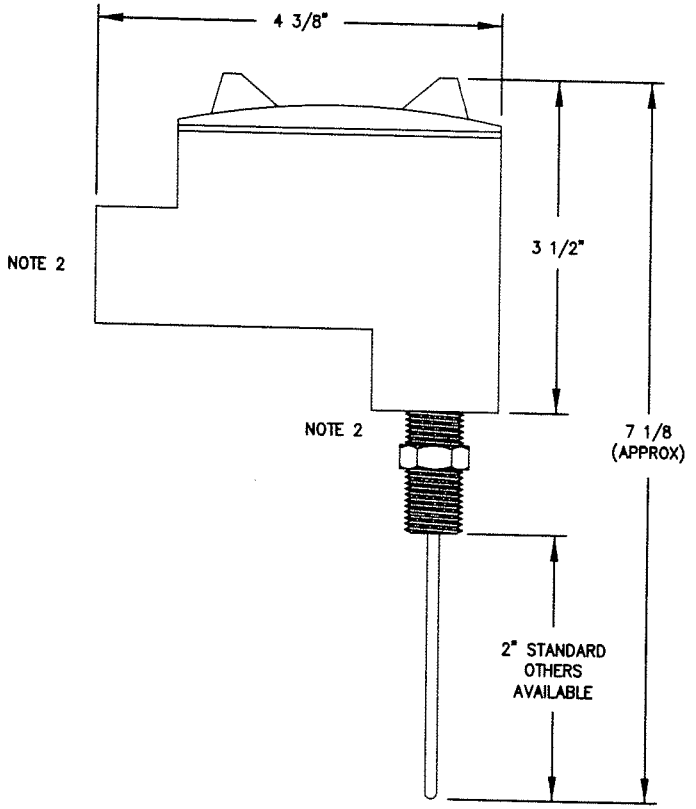
1. TWO WIRE TRANSMITTER IS A WEED INSTRUMENT MODEL 4500H RANGES AVAILABLE OVER -200 TO 850° C, CONSULT FACTORY FOR AVAILABLE SPANS.

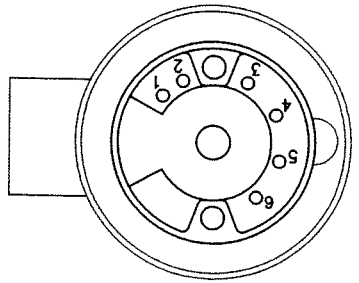
   OUTPUT: 4 TO 20mA
   RTD: 100 OHM @ 0° C
   POWER SUPPLY: 10VDC TO 35VDC.

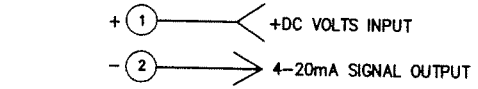
2. THREAD CONNECTIONS ARE 1/2" NPT ON PROCESS TAP AND FOR CONDUIT.

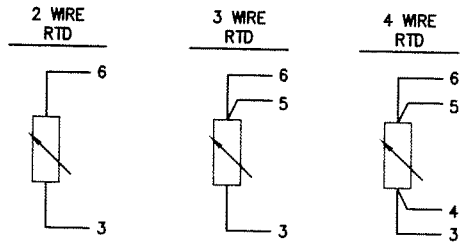
PT101-X-100-2-4500H(*)-GUAC/O-X

* SPECIFY TEMPERATURE RANGE WITH AT LEAST A 18° F SPREAD.









		MATERIAL	DRAWN	DATE
			CHECK	
			PROJ ENG	
		FINISH		
NEXT ASSY	USED ON			
APPLICATION				

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UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES OTHER THAN THE SIZE OF RAW MATERIAL SHALL BE HELD AS FOLLOWS:

2 PLACE DECIMALS	± .01
3 PLACE DECIMALS	± .005
FRACTIONAL	± 1/64
ANGULAR	± 1/2°

HOFFER FLOW CONTROLS, INC
ELIZABETH CITY, NC 27909

TITLE
INSTALLATION DRAWING, PT101

SIZE	CAGE CODE	DWG NO	REV
C	33321	TRANS-112	-

SCALE NONE SHEET 1 OF 1

DWG NO.	TRANS-102	SH 1	REV C

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APP
	A	DRAWING NO. WAS TRANS-102. (CS)	951106	JD
	B	REVISED PER CPA 310. (CS)	960214	KRH
	C	DRAWING NO WAS 500-0267 (CS)	961031	

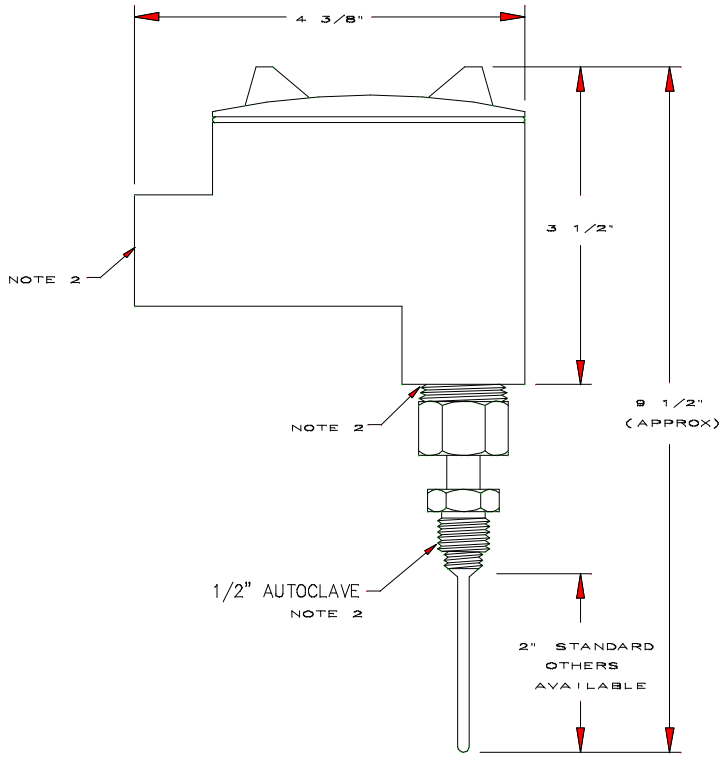
NOTES:

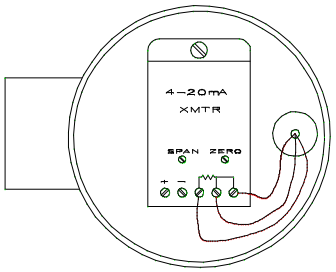
1. TWO WIRE TRANSMITTER IS A WEED INSTRUMENT MODEL 4154. RANGES AVAILABLE OVER -100 TO 600° C, CONSULT FACTORY FOR AVAILABLE SPANS.

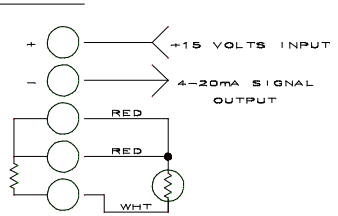
   OUTPUT: 4.0 TO 20mA
   RTD: 1000 OHM @ 0° C
   POWER SUPPLY: 9.5V TO 35VDC.

2. THREAD CONNECTIONS ARE 1/2" NPT FOR CONDUIT AND 1/2" AUTOCLAVE FOR PROCESS TAP.

3. OPERATIONAL TEMPERATURE LIMITS 0° - 50° C.







PT102-X-2-1000-4154(*)-GUAC/O-X

* SPECIFY TEMPERATURE RANGE WITH AT LEAST A 35° F SPREAD.

REPLACES 500-0267

		MATERIAL	DRAWN DW	DATE 2-7-92
			CHECK JD	2-7-92
			QA H.COVELL	2-7-92
		FINISH	PROJ ENG KRH	2-7-92
			MACH SHOP	
NEXT ASSY	USED ON			
APPLICATION				

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2 PLACE DECIMALS	± .01
3 PLACE DECIMALS	± .005
FRACTIONAL	± 1/64
ANGULAR	± 1/2°

HOFFER FLOW CONTROLS, INC
ELIZABETH CITY, NC 27909

TITLE
INSTALLATION DRAWING, PT102- TEMPERATURE PROBE

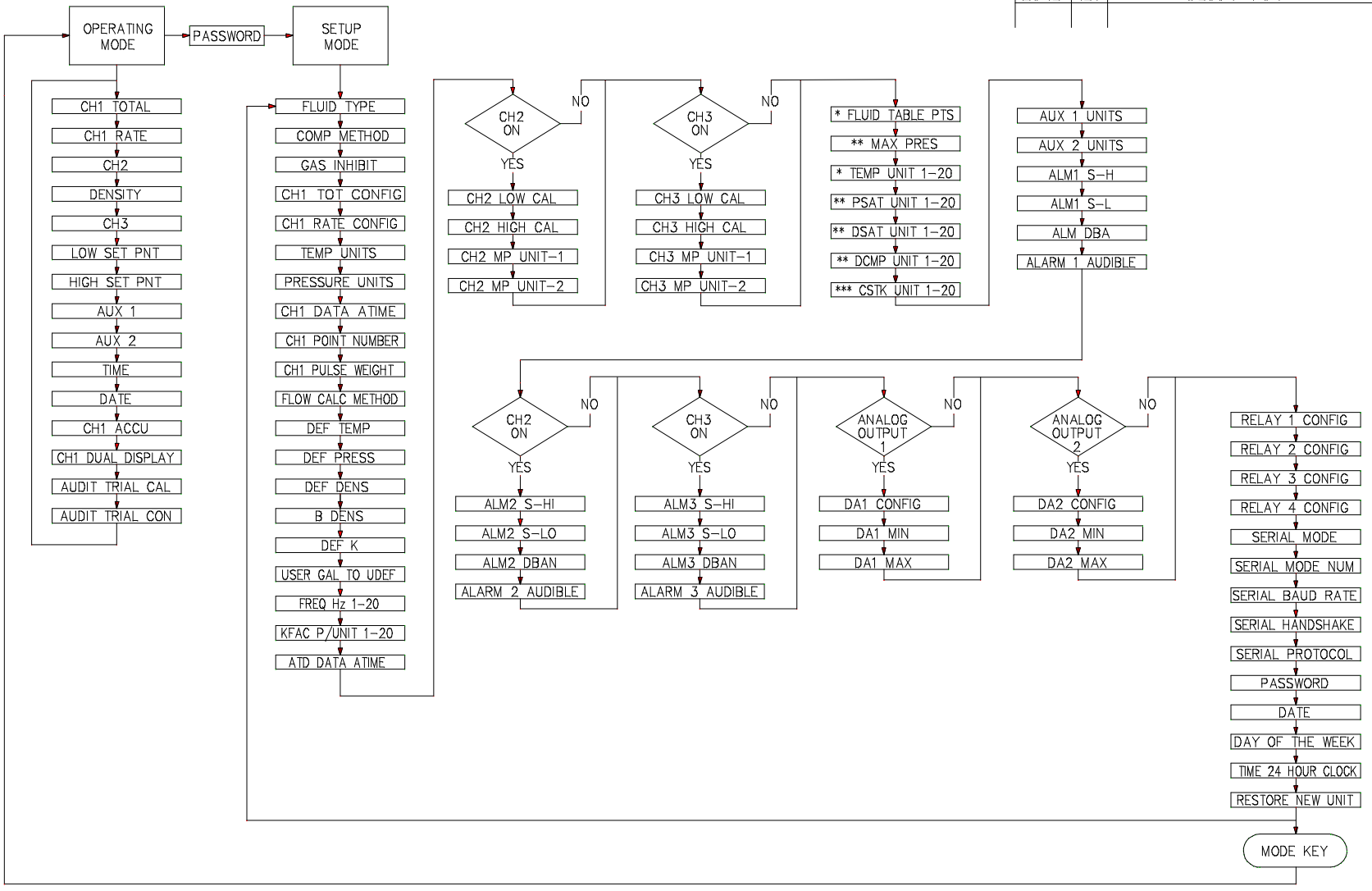
SIZE	CAGE CODE	DWG NO	REV
C	33321	TRANS-102	C

SCALE NONE SHEET 1 OF 1

DWG NO.	500-0349	SH 1	REV –

REVISIONS

ZONE	REV	DESCRIPTION	DATE	APP



SOFTWARE VER 1.04

* 1 DISPLAYED WHEN COMP METHOD IS SET IN EITHER TEMP OR TEMP & PRESSURE.

2 DISPLAYED WHEN FLOW CALC METHOD IS SET TO TEMP VS VISCOSITY.

** SEE 1 ABOVE

*** SEE 2 ABOVE

		MATERIAL	DRAWN	DATE
			CHECK	
			PROJ ENG	
		FINISH		
NEXT ASSY	USED ON	CONFIDENTIAL PROPERTY OF HOFFER FLOW CONTROLS, INC. (HFC) NOT TO BE DISCLOSED TO OTHERS, REPRODUCED, OR USED FOR ANY OTHER PURPOSE, EXCEPT AS AUTHORIZED IN WRITING BY HFC. MUST BE RETURNED ON DEMAND, ON COMPLETION OF ORDER OR OTHER PURPOSE FOR WHICH LENT.	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES, TOLERANCES OTHER THAN THE SIZE OF RAW MATERIAL SHALL BE HELD AS FOLLOWS: 2 PLACE DECIMALS ± .01; 3 PLACE DECIMALS ± .005; FRACTIONAL ± 1/64; ANGULAR ± 1/2?	
APPLICATION				

HOFFER FLOW CONTROLS, INC
ELIZABETH CITY, NC 27909

TITLE

FLOWSTAR 2005 FLOWCHART

SIZE	CAGE CODE	DWG NO	REV
C	33321	500-0349	–
SCALE	NONE		SHEET 1 OF 1